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Other: 8-97

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Site Characterization Summary Report

West Lake Landfill Operable Unit 1

Prepared For:

West Lake OU-1 Respondents Group

Prepared by:

Engineering Management Support, Inc.
12335 W. 53rd Avenue, Suite 201
Arvada, Colorado 80002

August, 1997



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SUPERFUND DIVISION

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Operable Unit 1**

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SEP 10 1997

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Telephone (303) 940-3428
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September 9, 1997

U.S. Environmental Protection Agency
Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

ATTENTION : Mr. Steve Kinser

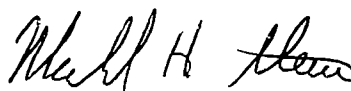
**SUBJECT : Revised Page Site Characterization Summary Report
West Lake Landfill Operable Unit 1, Bridgeton, Missouri**

Dear Mr. Kinser,

On behalf of Cotter Corporation (N.S.L.), Laidlaw Waste Systems (Bridgeton), Inc., Rock Road Industries, Inc., and the United States Department of Energy (the "Respondents"), Engineering Management Support Inc. (EMSI) is submitting revised page 8 for the Site Characterization Summary Report. Please discard the page included in our original submittal.

Please contact me if you have any questions.

Sincerely,
ENGINEERING MANAGEMENT SUPPORT, Inc.



Michael H. Stewart, P.E.

Distribution :

Steve Kovac - USEPA Region VII (w/o enclosure)
David A. Hoefer, Esq. - USEPA Region VII Regional Counsel (w/o enclosure)
John Niffenegger - Sverdrup
Doug Borro - Allied Waste Industries, Inc.
Ward Herst - Water Management Consultants
Michael Hockley - Spencer Fane Britt & Browne
Steve Landau - Cotter Corporation
Charlotte Neitzel - Holme Roberts & Owen
James Wagoner II - U. S. Department of Energy
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August 26, 1997

U.S. Environmental Protection Agency
Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

ATTENTION : Mr. Steve Kinser

**SUBJECT : Transmittal of Site Characterization Summary Report
West Lake Landfill OU-1 RI/FS**

Dear Steve,

On behalf of Cotter Corporation (N.S.L.), Laidlaw Waste Systems (Bridgeton), Inc., Rock Road Industries, Inc., and the United States Department of Energy (the "Respondents"), Engineering Management Support Inc. (EMSI) is submitting two copies of the Site Characterization Summary Report prepared for Operable Unit (OU) 1 at the West Lake Landfill. We are also sending one copy the above report to Mr. John Niffenegger of Sverdrup.

If you have any questions or desire additional information related to these reports or any other aspects of the project, please do not hesitate to contact us.

Sincerely,
ENGINEERING MANAGEMENT SUPPORT, Inc.

Michael Stewart For

Paul V. Rosasco, P.E.

Distribution :

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Charlotte Neitzel - Holme Roberts & Owen
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TABLE OF CONTENTS

Page

1.	INTRODUCTION	1
1.1	Purpose and Scope of the Site Characterization Summary Report	1
1.2	Organization of this Report	2
2.	SUMMARY OF PREVIOUS INVESTIGATIONS	3
2.1	Pre-RI Reports	3
2.2	OU-1 RI/FS Work Plans	3
2.3	Operable Unit-1 Site Investigation Reports	4
2.4	Operable Unit-2 Plans and Reports	4
2.5	Landfill Reports	5
2.6	Ford Property Reports	5
3.	SURFACE AND SUBSURFACE FEATURES	6
3.1	Site Description	6
3.2	Summary of Landfill Operations at the Site	7
3.2.1	Radiological Area 1	7
3.2.2	Radiological Area 2	8
3.2.3	Other Prior Landfill Operations	8
3.2.4	Current Landfill Operations	9
3.2.5	Activities Adjacent To The Site	9
3.3	Surface Features	9
3.3.1	Topography	9
3.3.2	Surface Soils	10
3.3.3	Site Drainage	11
3.3.3.1	Area 1 Drainage	11
3.3.3.2	Area 2 Drainage	12
3.3.4	Surface Water	12
3.3.5	Land Use	13
3.3.6	Biota	13
3.3.6.1	Plant Communities	14
3.3.6.2	Threatened and Endangered Species	16
3.3.6.3	Site Wildlife	17
3.4	Subsurface Features	17
3.4.1	Landfill Deposits	17
3.4.2	Geology	18
3.4.2.1	Bedrock Geology	18
3.4.3	Hydrogeology	19
3.4.3.1	Regional Hydrogeology	19
3.4.3.2	Water Supply Wells in the Vicinity of the Site	20
3.4.3.3	Site Hydrogeology	20

TABLE OF CONTENTS

	Page
4. SOURCE DISTRIBUTION	34
4.1 Source Distribution in Area 1 Soils	35
4.1.1 Area 1 Surface Source Distribution	35
4.1.2 Area 1 Subsurface Source Distribution	36
4.2 Source Distribution in Area 2 Soils	37
4.2.1 Area 2 Surface Source Distribution	37
4.2.2 Area 2 Subsurface Source Distribution	38
4.2.3 Ford Property Source Distribution	39
5. IDENTIFICATION OF POTENTIAL EXPOSURE PATHWAYS AND EXTENT OF MIGRATION	49
5.1 Airborne transport	49
5.1.1 Radon Gas	50
5.1.1.1 Surface Emission of Radon Gas	50
5.1.1.2 Radon Migration With Landfill Gas	51
5.1.2 Fugitive Dust	52
5.2 Direct Exposure To Source Materials	52
5.3 Rainwater Runoff Transport	53
5.3.1 Weir Runoff Samples	53
5.3.2 Surface Water Samples	54
5.4 Sediment Transport	55
5.4.1 Sediment Transport in Surface Drainages	55
5.4.1.1 Area 1 Surface Drainages	56
5.4.1.2 Area 2 Surface Drainages	57
5.4.2 Sediment Transport From Area 2 Slope Erosion	57
5.5 Migration in Perched Groundwater Or The Leachate Seep	58
5.5.1 Leaching to Groundwater and Subsequent Off-site Transport	58
5.6 Direct Exposure To Seeps	59
6. SUMMARY – REVISED CONCEPTUAL MODEL	70
6.1 Summary of Site Conditions- Revised Conceptual Model	70
6.1.1 Surface Setting	70
6.1.2 Subsurface Setting	71
6.2 Contaminant Sources	73
6.3 Potential Migration Pathways	74
6.4 Potential Exposure Pathways	75
6.5 Fate and Transport Modeling	75
7. REFERENCES	77

Table of Contents (continued)

Page

Tables

Table 3-1 : Plant Species Identified at the West Lake Landfill	22
Table 4-1 : Summary of Radiological Levels for Surface Materials in Area 1	40
Table 4-2 : Summary of Radiological Levels for Subsurface Materials in Area 1	41
Table 4-3 : Summary of Radiological Levels for Surface Materials in Area 2	42
Table 4-4 : Summary of Radiological Levels for Subsurface Materials in Area 2	43
Table 4-5 : Ford Property Analytical Results	44
Table 5-1 : Radon Flux Results	60
Table 5-2 : Rainwater Runoff Results	61
Table 5-3 : Surface Water Sample Results	62
Table 5-4 : Sediment Sample Results	64
Table 5-5 : May 1997 Groundwater Monitoring Results and Historic Values From Background Wells	67
Table 5-6 : Groundwater Radium-226 Data Comparison	68
Table 6-1 : Summary of Potential Exposure Pathways for OU-1	76

Figures

Figure 3-1: Site Vicinity Map	23
Figure 3-2: Site Location Map	24
Figure 3-3: Site Ownership In Vicinity of Area 1 and Area 2	25
Figure 3-4: Landfill and Surrounding Area Zoning	26
Figure 3-5: Areas of Landfill Operations	27
Figure 3-6: Area 1 and 2 Drainage Patterns and Runoff Locations	28
Figure 3-7: Hydrophilic Vegetated Communities in Area 1	29
Figure 3-8: Hydrophilic Vegetated Communities in Area 2	30
Figure 3-9: Generalized Stratigraphic Column for the St. Louis Area	31
Figure 3-10: Locations of Water Supply Wells in the Vicinity of the Site	32
Figure 3-11: Locations of Perched Water Bodies	33
Figure 4-1: Summary of Surface Radiological Results	46
Figure 4-2: Summary of Subsurface Radiological Results	47
Figure 4-3: Summary of Results for the Ford Property	48
Figure 5-1: Wier, Sediment, Surface Water and Groundwater Sampling Locations	69

Appendix

A	Compilation of Analytical Data Collected By McLaren/Hart and EMSI
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1. INTRODUCTION

This Site Characterization Summary Report (SCSR) has been prepared by Engineering Management Support Inc. (EMSI) on behalf of Cotter Corporation (N.S.L.), Laidlaw Waste Systems (Bridgeton), Inc., Rock Road Industries, Inc., and the United States Department of Energy (the "Respondents"). The SCSR has been prepared as part of the Remedial Investigation/Feasibility Study (RI/FS) for Operable Unit (OU) -1 at the West Lake Landfill site (the Site) located in Bridgeton, Missouri. OU-1 addresses conditions associated with two areas of radiological impacted soils present at the Site, Radiological Area 1 (Area 1) and Radiological Area 2 (Area 2). Others are investigating other parts of the Site, including occurrences of non-radioactive constituents, as part of OU-2 at the Site.

This report has been prepared in accordance with the requirements of Administrative Order on Consent (AOC) between the U.S. Environmental Protection Agency (EPA) and the Respondents for OU-1 at the West Lake Landfill. Specifically, this report presents the information required by Section 4.4.2 of the Remedial Investigation/Feasibility Study (RI/FS) Statement of Work (SOW) to the AOC.

1.1 Purpose and Scope of the Site Characterization Summary Report

The purpose of the SCSR is to present the results of the various Site characterization activities for use in completing the Remedial Investigation (RI), Baseline Risk Assessment (BRA), and Feasibility Study (FS) for OU-1. The SCSR was originally intended as a summary document to assist EPA in the preparation of a BRA. The AOC was subsequently amended to allow the Respondents to develop the BRA; therefore, the SCSR will provide an interim evaluation of Site conditions for EPA and the Respondents and will be used as a summary document by the Respondents' risk assessors to assist in preparation of the BRA.

As required by Section 4.4.2 of the SOW of the AOC, the SCSR is to include the following evaluations:

- Review of the investigative activities that have taken place;
- Description and display of the data documenting the location and characteristics of subsurface and surface features;
- Description and display of the data documenting contamination at the Site including the affected media, location, types, physical state, contaminant concentrations and quantities; and

- Documentation of the location, dimensions, physical condition, and varying concentration of each contaminant throughout each source and the extent of contaminant migration through each of the affected media.

Each of these requirements is addressed in later sections of this report.

1.2 Organization of this Report

The remainder of this report is organized as follows:

- Section 2 presents a summary of previous investigations;
- Section 3 presents a description of the location and characteristics of surface and subsurface features at the Site;
- Section 4 describes the sources of contamination at the Site including affected media, location, types of contamination, physical state of contaminants, contaminant concentrations and quantity of contaminants and affected media;
- Section 5 describes the potential migration pathways at the Site and a description of the extent of migration, if any, along each pathway;
- Section 6 presents a summary of the Site conditions and revised conceptual model of the Site and discusses the need for and potential scope of possible fate and transport modeling that may be required for completion of the RI and BRA.
- Section 7 lists the various references used in completing this report.

acres of the 200-acre property (Figure 2). About 130,000 cubic yards of contaminated soil are reported in this area.

A limestone ridge wall and a portion of a previously filled and capped quarry landfill separate the existing quarry pit from Area 1. The current landfill operation has an active, negative pressure landfill gas (LFG) collection system comprised of several LFG collector wells which feed a utility flare located east of Area 1. This area has since been quarried, filled with municipal solid waste (MSW), and capped.

A passive methane collection system, consisting of several individual large-diameter concrete conduits, has also been installed in the current quarry pit which is presently being filled with MSW (the active area - Figure 2).

2.1 Previous Site Investigations

This section briefly summarizes the present understanding of applicable Site conditions based on information presented in the above RFP; personal interviews and telephone conversations with Laidlaw employees; and a review of the Phase I and Draft Phase II Environmental Investigations conducted by R.M. Wester & Associates.

In 1976, the U.S. Nuclear Regulatory Commission (NRC), Region III, investigated the disposal of radioactive wastes in the West Lake Landfill located adjacent to the Laidlaw Sanitary Landfill Site. This investigation revealed that about seven tons of U_3O_8 contained in 8,700 tons of leached barium sulfate residues, had been mixed with about 40,000 tons of soil at the Cotter Corporation Latty Avenue facility, and the entire volume disposed of at the West Lake Landfill. The results of previous radiological assessments indicate that the disposed materials contained uranium and/or thorium decay chain nuclides and potassium-40. The concentrations ranged from 1 to 19,000 picoCuries per gram (pCi/gm).

2. SUMMARY OF PREVIOUS INVESTIGATIONS

Numerous investigations of the Site conditions have previously been prepared. These include pre-RI reports, the RI/FS Work Plan and related documents, field and laboratory investigations for the OU-1 RI/FS, work plan documents and Site characterization reports prepared for OU-2, reports prepared as part of the development and operations of the Site, and investigative reports associated with the Ford property located immediately northwest of Area 2. These investigations are described below.

2.1 Pre-RI Reports

The following reports were prepared prior to the initiation of the RI/FS for the Site:

- Report of Site Visit - West Lake Landfill, St. Louis County, Missouri (Radiation Management Corporation, 1981)
- Radiological Survey of the West Lake Landfill, St. Louis County, Missouri (Radiation Management Corporation, 1982)
- Radioactive Material in the West Lake Landfill, Summary Report (U.S. Nuclear Regulatory Agency, 1988)
- Letter from Rodney Bloese to Joseph Homsy re: West Lake Landfill CERCLA dated December 12, 1989, (Foth & Van Dyke, 1989) (contains information on local water wells)
- Preliminary Health Assessment, West Lake Landfill, Bridgeton, St. Louis County, Missouri (Missouri Department of Health, 1991)

2.2 OU-1 RI/FS Work Plans

The following planning documents were previously prepared as part of the RI/FS for OU-1:

- RI/FS Work Plan for the West Lake Site, Bridgeton, Missouri, August 15, 1994 (McLaren/Hart, 1994)
- Amended Sampling and Analysis Plan, West Lake Landfill Operable Unit 1, January 29, 1997 (EMSI, 1997a)

2.3 Operable Unit-1 Site Investigation Reports

The following investigative documents were previously prepared as part of the RI/FS for OU-1:

- Overland Gamma Survey Report, West Lake Landfill Radiological Areas 1 & 2, April 30, 1996 (McLaren/Hart, 1996a);
- Site Reconnaissance Report, West Lake Landfill Radiological Areas 1 & 2, May 16, 1996 (McLaren/Hart, 1996b), and;
- Threatened or Endangered Species Assessment Report, West Lake Landfill Radiological Areas 1 & 2, May 17, 1996 (McLaren/Hart, 1996c);
- Radon Gas, Landfill Gas and Fugitive Dust Report, West Lake Landfill Areas 1 & 2, November 22, 1996 (McLaren/Hart, 1996d);
- Rainwater Runoff, Erosional Sediment, Surface Water, and Leachate Sampling Data Report, West Lake Landfill Areas 1 & 2, November 22, 1996 (McLaren/Hart, 1996e);
- Split Soil and Groundwater Sampling Data Summary Report, West Lake Landfill Areas 1 & 2, November 22, 1996 (McLaren/Hart, 1996f);
- Groundwater Conditions Report, West Lake Landfill Areas 1 & 2, November 26, 1996 (McLaren/Hart, 1996g),
- Soil Boring/Surface Soil Investigation Report, West Lake Landfill Areas 1 & 2, November 26, 1996 (McLaren/Hart, 1996h), and
- Interim Investigation Results Technical Memorandum, West Lake Landfill OPERABLE UNIT 1, January 28, 1997 (EMSI, 1997b).

2.4 Operable Unit-2 Plans and Reports

The following investigative documents were previously prepared as part of the RI/FS for OU-2:

- Remedial Investigation/Feasibility Study Work Plan (Golder Associates, 1995a)

- Draft Hydrogeological Characterization Report for the Bridgeton Active Sanitary Landfill, Bridgeton, Missouri, September 1995 (Golder Associates, 1995b)
- Physical Characterization Technical Memorandum for the West Lake Landfill Operable Unit 2, Bridgeton, Missouri, November 1996 (Golder Associates, 1996a)

2.5 Landfill Reports

The following reports were prepared in support of the ongoing landfill operations at the Site:

- Environmental Investigation and Health Impact Assessment, Bridgeton Sanitary Landfill, October 1993 (Golder Associates, 1993)
- Radiological Survey of West Lake Landfill Bridgeton, Missouri, June 4, 1996 (Golder Associates, 1996b)

2.6 Ford Property Reports

In addition to the studies of the Ford property discussed in the OU-1 Site investigation reports, the following investigative reports have been prepared specifically for the Ford property located to the northwest and adjacent to Radiological Area 2:

- Phase II Investigation Report (Dames & Moore, 1990)
- Phase III Radiological Site Assessment, Earth City Industrial Park (Dames & Moore, 1991)

All of the above reports were reviewed during the preparation of this document. Information, data and interpretations from each report were incorporated as applicable.

3. SURFACE AND SUBSURFACE FEATURES

This section describes the surface and subsurface features present at the Site. Included are discussions of the overall location and general description of the Site conditions, a summary of the past landfill operations in Areas 1 and 2 as well as the other parts of the Site, a discussion of the surface conditions that currently exist at the Site and an interpretation of the subsurface conditions beneath the Site.

3.1 Site Description

The Site is located within the western portion of the St. Louis metropolitan area to the east of the Missouri River. The Site is situated approximately one mile to the north of the intersection of Interstate 70 and Interstate 270 within the city limits of the City of Bridgeton in northwestern St. Louis County.

The Site is an approximately 200 acre parcel containing multiple facilities. The primary facility, the Laidlaw Landfill (formerly the West Lake Landfill) has an address of 13570 St. Charles Rock Road, St. Louis County, Missouri (Figure 3-1). The Site is bordered on the north by St. Charles Rock Road (State Highway 180) and on the southeast by Taussig Road and agricultural land. Old St. Charles Rock Road, along with undeveloped land, borders the southern and western portions of the Site (Figure 3-2).

The Site includes an active solid waste landfill, an inactive demolition landfill, and an inactive sanitary landfill. In addition, included within the boundaries of the Site as defined in the OU-2 Work Plan, are concrete and asphalt batch plants, an automobile repair shop and a former telephone switching station although these operations are not the subject of the RI/FS. Current surface ownership of the Site is depicted on Figure 3-3. Current zoning for the Site is shown on Figure 3-4.

A 6-foot high chain-link fence with a 3-strand barbed wire canopy encloses the entire Site. The main access gate is located on the northeastern perimeter off of St. Charles Rock Road. An additional gate is located on the southwestern perimeter to provide access to the borrow area located across old St. Charles Rock Road. A third gate provides access to the automobile repair shop.

The Earth City industrial park is adjacent to the Site on the west across Old St. Charles Rock Road. Property to the north of the Site, across St. Charles Rock Road, is moderately developed with commercial, retail and manufacturing operations. Surrounding area zoning is depicted on Figure 3-4.

3.2 Summary of Landfill Operations at the Site

The Site is comprised of approximately 200 acres. Limestone was quarried from the Site from 1939 to 1988. Beginning in the early 1950s or perhaps the late 1940s, portions of the quarried areas and adjacent areas were used for landfilling municipal refuse, industrial solid wastes and construction demolition debris. It has been alleged, but never substantiated, that liquid wastes were also placed in the landfill. These activities were not subject to State permitting, and this portion of the landfill activities has been termed the "unregulated landfill". In 1974, a State landfill permit was obtained and landfilling began in the portion of the Site described below as the North Quarry Pit. Landfilling continued in this area until 1985 when the landfill underwent expansion to the southeast in the area described below as the South Quarry Pit. Landfill activities conducted after 1974 within the quarry area were subject to a permit from the Missouri Department of Natural Resources (MDNR) and hence have been referred to as the "regulated landfill".

The landfill can be divided into six distinct areas (Figure 3-5) including:

- Radiological Area 1 within and adjacent to the North Quarry Pit inactive sanitary landfill
- Radiological Area 2 within the inactive demolition landfill
- Inactive demolition landfill (excluding Area 2)
- Inactive sanitary landfill
- North Quarry Pit inactive sanitary landfill (excluding Area 1), and
- South Quarry Pit landfill (the active sanitary landfill).

The focus of OU-1 is Radiological Areas 1 and 2.

Each of these areas are discussed briefly below. There also is a surface water retention pond, abandoned leachate lagoons and an active leachate retention pond associated with the sanitary landfill operations.

3.2.1 Radiological Area 1

Radiological Area 1 is located immediately to the southeast of the Site entrance. This area was part of the unregulated landfill operations conducted prior to 1974. Based on the drilling logs obtained as part of the RI/FS investigations for OU-1, the waste materials consist of municipal refuse with an average thickness of approximately 36 feet.

Based on the results of the Overland Gamma Survey conducted as part of the RI/FS (McLaren/Hart, 1996a), Area 1 consists of approximately 10 acres that have been

impacted by radiological materials. There is an asphalt entrance road and parking area located on the northwestern border of Area 1 near the Site office building. The remaining portions of Area 1 are mainly covered with grass. An underground diesel tank is located beneath the asphalt paved area in the western portion of Area 1. The tank is no longer in use but has not been removed because it is within the boundaries of Area 1.

3.2.2 Radiological Area 2

Radiological Area 2 is located in the northwestern part of the Site. This area was also part of the unregulated landfill operations conducted prior to 1974. Based on the drilling logs obtained as part of the RI/FS investigations for OU-1, the waste materials consist of construction and demolition debris and municipal refuse with an average thickness of approximately 30 feet.

Based on the results of the Overland Gamma Survey conducted as part of the RI/FS (McLaren/Hart, 1996a), Area 2 consists of approximately 30 acres that have been impacted by radiological materials. Large portions of this area are covered with grasses, native bushes and trees while other portions are unvegetated and covered with soil, gravel, concrete rubble and miscellaneous debris consisting of concrete pipe, metal and automobile parts, discarded building materials, and other non-perishable materials. Scattered throughout Area 2 are a number of small depressions, some of which seasonally contain ponded water and phreatophytes such as cattails. The northern and western portions of Area 2 are bounded by the landfill berm, the slopes of which are covered with a dense growth of trees, vines and bushes.

3.2.3 Other Prior Landfill Operations

In addition to Radiological Areas 1 and 2, an inactive demolition landfill and an inactive sanitary landfill area are located in the north central part of the Site. The inactive demolition landfill is located on the southeast side of Radiological Area 2, between Area 2 and the landfill entrance road. The inactive sanitary landfill is located to the southwest of the inactive demolition landfill. As with the landfill operations conducted in Areas 1 and 2, the operations conducted in these areas were also part of the unregulated landfill operations conducted prior to 1974. Wastes disposed of in this area are believed to consist of sanitary wastes, a variety of other solid wastes and demolition wastes.

3.2.4 Current Landfill Operations

The north quarry pit and the south quarry pit, are associated with current landfilling operations. Landfilling activities conducted in these areas are subject to a permit issued by MDNR and as such, extensive information is available regarding the operations conducted and the nature and configuration of the waste materials disposed of in these areas (McLaren/Hart, 1994).

3.2.5 Activities Adjacent To The Site

The property on the west side of Area 2 (the Ford property) is currently being developed as an industrial park. The subdivision plat for the Ford property, known as Crossroads Industrial Park, currently reflects a 1.785 acre buffer created adjacent to the Area 2 slope. The buffer includes the area of radiological impacted surface soils as identified in the "Phase III Radiological Assessment" performed by Dames & Moore for Ford Financial Services Group in 1991. The boundary of the buffer zone is shown on Figure 4-3.

3.3 Surface Features

This section includes a description of the Site topographic conditions, surface soil conditions, runoff drainage patterns, surface water bodies in the area, current land uses, and biota conditions at and near the Site.

3.3.1 Topography

The Site is situated on the eastern edge of the Missouri River floodplain. The Missouri River is located approximately two miles to the west of the Site. The river flows in a predominantly north-northeasterly direction in the vicinity of the Site at an elevation of approximately 425 feet based on the National Geodetic Vertical Datum (NGVD). The river is separated from the surrounding areas by a levee system constructed to an average elevation of approximately 435 to 440 feet in this area (McLaren/Hart, 1994).

The Site is located in an area that is transitional between the floodplain immediately to the west and the loessial bluffs approximately one-half mile to the east. The edge of the river valley is oriented north to south through the center of the Site. The topography of this area is gently rolling ranging in elevation from approximately 430 to 500 feet (NGVD). Site elevations (exclusive of the quarry areas) range from approximately 450 to 500 feet (NGVD); however, the Site topography has been

significantly altered by quarry activities in the eastern portion of the Site, and by placement of mine spoils (unused quarry material) and landfill materials in the western portion of the Site.

Area 1 is situated on the north and western slopes of a topographically high area within the landfill. Ground surface elevation varies from 490 feet above mean sea level (AMSL) on the south to 452 feet at the roadway near the Site property entrance.

Area 2 is situated between a topographic high of landfilled material on the south and the Ford property on the north. The highest elevations are in the southwest of Area 2 where the flank of the topographic high of landfilled materials extends into this area. The topographic high in this area is about 500 feet sloping to approximately 470 feet near the top of the landfill berm along the south side of the Ford property. The northern portions of the landfill are bounded by a large berm. As a result, the upper surface of Area 2 is located approximately 20 to 30 feet above the adjacent Ford property on the north and west and the north surface water body, discussed below in Section 3.3.3, that is located in the northernmost corner of the Site. The upper surface of Area 2 is approximately 30 to 40 feet higher than the water surface in the flood control channel, discussed below in Section 3.3.3, that is located to the west of Area 2.

The majority of Area 2 slopes to the north-northeast; however the surface is irregularly graded with elevations varying from 460 to 480 feet. A large topographic depression is located near and along the northern berm of the landfill. The elevation of the bottom of this closed depression is 456 feet.

3.3.2 Surface Soils

According to the U.S. Soil Conservation Service (SCS), surficial soils along the floodplain of the Missouri River generally consist of Blake-Eudora-Waldron association while the surficial soils on the bluffs east of the river are the Urban Land-Harvester-Fishpot association (SCS, 1982). The floodplain materials are described as nearly level, somewhat poorly drained to well drained, deep soils formed in alluvial sediment. The upland materials are urban land and nearly level to moderately steep, moderately well drained to somewhat poorly drained, deep soils formed in silty fill material, loess and alluvium which are formed on uplands, terraces, and bottom lands.

Soils in the area of the Site consist of the Freeburg-Ashton-Weller association, which are nearly level to gently sloping, somewhat poorly drained, deep soils formed in loess and alluvial sediment. The Freeburg silt loam is found on the terrace adjacent to the eastern Site boundary, while the Ashton silt loam is found to the east and south of the south pit (including the landfill borrow area).

The Freeburg unit is identified as a somewhat poorly drained silt loam to silty clay loam, up to 60 inches thick. The permeability of this soil is characterized by the SCS as moderately slow (about 10^{-4} centimeters per second [cm/sec]), and the surface runoff is medium. According to the SCS, a perched water table is often present within this unit in the spring at a depth of 1.5 to 3 feet. The Freeburg unit's suitability for landfill cover material is described as fair due to its clay content (12 to 35%) and wetness.

The Ashton unit is a well-drained silty loam to silty clay loam, also up to 60 inches thick. The permeability of this unit is also moderately slow and the surface runoff is medium. The suitability of the Ashton unit for landfill cover material is described as fair due to the clay content (10 to 40%).

Soil materials present as cover materials in and on the surface of Areas 1 and 2 were derived primarily from onsite materials and from quarry fines consisting primarily of shale materials. The only exception to the use of on-site soils was the reported use of 8,700 tons of leached barium sulfate originating from uranium-ore processing operations mixed with approximately 39,000 tons of soil, which the landfill owner and operator believe was used as cover materials.

3.3.3 Site Drainage

Surface water runoff patterns for Areas 1 and 2 are presented on Figure 3-6. Runoff from Area 1 ultimately flows into the surface water body located north of Area 2 (the north surface water body). Runoff from Area 2 flows into a closed topographic depression located behind the landfill berm, into the north surface water body, or to the south down the landfill access road and ultimately into the north surface water body. A very limited volume of runoff may flow through the breach in the Area 2 berm down the landfill slope and onto the margin of the Ford property. Although a portion of Area 2 is bounded by the flood control channel discussed below, no runoff from Area 2 flows into this water body.

3.3.3.1 Area 1 Drainage

The majority of the runoff from Area 1 ultimately flows into the north surface water body. Four locations (Weirs 1, 2, 3, and 4) where rainwater runoff flows from Area 1 were identified (Figure 3-6). All four locations are located in the northern portion of Area 1 and discharge into the drainage ditch located on the south side of the Site entrance road. Flow in this ditch occurs in a northeasterly direction and exits the West Lake property through a culvert beneath the entrance road near the property fence-line. From here, runoff flows in a ditch located along the east side of St. Charles Rock Road and ultimately into the north surface water body located at the northernmost end of the Site.

As previously indicated, the ground surface of Area 1 is irregular and some of the runoff flows into and accumulates in several small topographic depressions in this area. Standing water of up to six inches in depth has been reported to be present in these topographic lows following precipitation events.

3.3.3.2 Area 2 Drainage

The majority of the runoff from Area 2 flows into the closed topographic depression located in the southeastern portion of Area 2. Five locations at which runoff flows offsite from Area 2 were identified by McLaren/Hart (1996b and 1996e). Three of these locations (Weirs 5, 6 and 7) are at the top of the slope above the landfill berm in the western portion of Area 2 above the buffer on the Ford property. These locations were identified by erosional runnels. With the exception of one heavy storm in mid-May 1995, flow was only observed at one of these locations. This location, Weir 5, is located in the vicinity of the historic berm failure and resulting erosional runoff that led to the accumulation of radiological impacted soil in the southern portion of the Ford property (Figure 3-6). At the other two locations, water has to pond up to a sufficient height to over-top a berm at the top of the landfill slope before any flow will occur. Based on observations made throughout the course of the RI field investigations, it was concluded by McLaren/Hart that this is not a frequent occurrence.

Two additional locations (Weirs 8 and 9) of offsite flow are located in the southern portion of Area 2 near the roadway in the area used for storage of roll-off bins (Figure 3-6). These areas appear to be areas where runoff occurs primarily as sheet flow and extensive erosional runnelling was not observed in this area. Runoff from the roll-off storage bin area and the demolition landfill area commingles with runoff from Area 2 in the vicinity of Weirs 8 and 9.

3.3.4 Surface Water

There are two surface water bodies present in the vicinity of OU-1. These are the north surface water body and the flood control channel associated with Earth City (Figure 3-6). There are two additional surface water bodies present, the surface water detention pond and the leachate lagoon that are associated with the current landfilling operations. As discussed above, runoff from Area 2 has not reached the flood control channel. In addition, the surface water detention pond and the leachate lagoon are all hydraulically isolated from Area 1 and Area 2 so they cannot receive any surface water runoff from these regions.

The north surface water body receives water from the drainage ditch that separates St. Charles Rock Road from the Site. The body contains water throughout the year.

Measurements made by McLaren/Hart indicate a water level fluctuation between approximately 435.4 and 437.3 feet (NVGD).

The flood control channel is part of an extensive set of interconnected channels that are used to maintain drainage within Earth City. Water levels in the channel generally remain relatively constant throughout the year. The water level is changed by the City of Earth City as necessary by pumping large volumes of water to the Missouri River. Measurements made by McLaren/Hart indicate a water level fluctuation between approximately 432.5 and 434.5 (NVGD).

3.3.5 Land Use

The Site is located in a predominately industrial area. The southern portion of the Site is zoned M-1 (manufacturing district, limited). The southernmost portion of the Site is permitted for active sanitary landfill operations (Permit No. 118912). Although the northern portion of the Site is zoned R-1 (one family dwelling district), a deed restriction has been recorded against the entire Site to prohibit residential use and groundwater use. The deed restriction cannot be terminated without the written approval of the current owners, MDNR and EPA.

The property to the north of the Site, across St. Charles Rock Road, is moderately developed with commercial, retail and manufacturing operations. The Earth City industrial park is located adjacent to the Site on the west, across Old St. Charles Rock Road. The nearest residential development, "Spanish Village", is located to the south of the Site near the intersection of St. Charles Rock Road and I-270 approximately ¾ mile from Area 1 and one mile from Area 2. Mixed commercial, retail, manufacturing and single family residential uses are present to the southeast of the Site. The land use zoning for the Site and surrounding area is shown on Figure 3-4.

3.3.6 Biota

An assessment of the plant communities present at the Site, the potential for the presence of threatened or endangered species and a description of the types of wildlife observed to be present at the Site was performed by McLaren/Hart (1996c) as part of the RI/FS investigations. The results of this survey are presented in the report and are briefly summarized below.

3.3.6.1 Plant Communities

Three types of plant communities were identified in Areas 1 and 2. Plant species identified in both areas are summarized in Table 3-1. These include old field and hydrophilic plant communities identified in both Areas 1 and 2 and a forest plant community identified in Area 2 only. The old field plant community consists of open areas dominated by weedy species such as herbs, grasses and occasional sun-loving, fast-growing trees. Old fields typically contain annual, biannual and perennial herbaceous plants, mixed among grasses and a few pioneer woody species (Kricher and Morrison, 1988). The hydrophilic communities are defined as areas, irrespective of size, that contain ponded water or vegetation typically adapted for saturated soil conditions. Forested plant communities are dominated by woody plant species (trees) that have a well-developed canopy and under-story (Kricher and Morrison, 1988).

A fourth plant community, a maintained field community, was identified in areas adjacent to the Site. Maintained field communities consist of open areas dominated by grass species. These areas are maintained by mowing at a frequency of at least once per year.

Area 1 Plant Communities

Area 1 consists predominantly of old field community dominated by grasses and various herbaceous plant species interspersed with six small depressions dominated by hydrophilic vegetation (Figure 3-8). The old field community in Area 1 was dominated by various grass species such as bluestem, foxtail, and other grasses. Other dominant herbaceous species noted include goldenrod, nodding thistle and curled dock. Other species noted included common plantain and field pennycress. No woody species were observed to be dominant in Area 1.

Six small isolated areas of hydrophilic plant communities were identified in Area 1 (Figure 3-7). These species included herbaceous vegetation such as rushes, curled dock, and cattail. A green algae, *Spirogyra spp.*, was also present in two areas in which standing water was observed. All of the hydrophilic communities were present in small surface depressions in the landfill cap that likely are the result of differential landfill subsidence over time and resultant poor surface drainage.

Area 2 Plant Communities

Area 2 plant communities include an old field community, a forested berm area dominated by woody vegetation and small isolated hydrophilic communities containing cattails and other hydrophilic species (Figure 3-8). The old field plant community dominates the majority of Area 2. This community is present over the majority of the

landfill surface between the landfill berm on the north and west margins of this area and the active landfill operations located to the east and south of this area. The old field community in Area 2 was dominated by invasive herbaceous species such as nodding thistle, yellow sheet clover and goldenrod. Various grass species were also noted to be present. Woody species including numerous young stands of staghorn sumac and eastern cottonwoods were also present in Area 2.

The landfill berm along the north and west boundaries of Area 2 contains a forest plant community. This community consists of dominantly woody species including eastern cottonwood, willows, dogwoods and ash trees. A species of grape was the dominant vine present in the forested community of Area 2. Bedstraw and other old field species are present along the edge habitat between the forest community and the old field community.

Ten small isolated areas containing plant species typical of hydrophilic communities were identified in Area 2 (Figure 3-8). In most of these areas, cattails were the only, or the dominant species present. Similar to Area 1, these areas are present in small depressions presumably the result of differential settlement in the landfill cap and resultant obstruction of the surface water drainage in these areas.

Plant Communities in Other Areas at or Near the Site

Plant communities were characterized for three other areas adjacent to Areas 1 and 2. These include the north surface water body, the south flood control channel and the uncultivated portion of the Ford property north of Area 2.

The north surface water body is located to the northeast of Area 2 at the northernmost corner of the Site property. A forest-type plant community that includes eastern cottonwoods, ashes, dogwoods, and willows dominate the edges of this surface water body. The canopy cover and under-story are dense in the vicinity of Area 2. The vegetation associated with the north surface water body is a continuation of the adjacent plant community located on the landfill berm on the north and west margins of Area 2. The banks of the north surface water body are not well defined and at the time of the plant assessment, water flow appeared to be very slow to non-existent in the north surface water body.

The south flood control channel is located off of the Site on property associated with the Earth City development. Access to the south flood control channel from the Site is restricted by a fence. The south flood control channel consists of well-defined, man-made bed and banks. The shores of the flood control channel consist of a maintained field community.

The Ford property located to the north and west of Area 2 consists of an old field community. This area is not currently farmed and has not been farmed since the 1980's.

Dominant plant species in this area include nodding thistle, goldenrod, daisy fleabane, yellow sweet clover and various grasses.

3.3.6.2 Threatened and Endangered Species

Federal and State listings of threatened and endangered species were requested from the U.S. Fish & Wildlife Service (USFWS) and from the Missouri Department of Conservation (MDOC) by McLaren/Hart as part of their activities related to preparation of the RI/FS Work Plan (McLaren/Hart, 1994). The USFWS responded that "No federally-listed endangered or threatened species occur in the project area" (USFWS, 1994). The MDOC responded that "Department staff examined map and computer files for federal and state threatened and endangered species and determined that no sensitive species or communities are known to occur on the immediate Site or surrounding area" (MDOC, 1994).

Subsequent to these letters, Ms. Cherri Baysinger-Daniels of the Missouri Department of Health (MDH) stated that on October 23, 1994 she observed a Western Fox Snake (*Elaphe vulpina vulpina*), a Missouri state-listed endangered species, at the Site. The western fox snake is a marsh-dwelling member of the rat snake group (MDOC, 1992). This snake is believed to be an inhabitant of open grasslands and the borders of woods. In Missouri, the fox snake has been found near large natural marshes (MDOC, 1992). The western fox snake has currently been documented to be present only in St. Charles and Lincoln counties (MDOC, 1994 and 1995).

In response to Ms. Baysinger-Daniels' observation, McLaren/Hart requested another data base search of the western fox snake's distribution in Missouri (McLaren/Hart, 1996c). This second search indicated that there were no records of occurrences of the western fox snake reported for St. Louis County, Missouri. If Ms. Baysinger-Daniels' preliminary observation had been verified, the presence of the western fox snake at the Site would represent a new location for this species and a new county record. A voucher specimen is required to adequately document a new county record (MDOC, 1995). A photograph of a specimen, showing both the dorsal and ventral views, would suffice as a voucher specimen (MDOC, 1995). As a voucher specimen was not obtained, Ms. Baysinger-Daniels' observation alone is insufficient to verify an occurrence of the western fox snake in St. Louis county.

During the field survey, McLaren/Hart examined areas most likely to be inhabited by the western fox snake in an effort to verify and document Ms. Baysinger-Daniels' observation. Each vegetative community, with emphasis on marshy areas, was qualitatively examined for the presence of the western fox snake or other reptiles. The reptile search was performed concurrently with the evaluation of the vegetative communities. Basking areas, large rocks, logs and pieces of plywood were examined for

the presence of snakes. No specimens of the western fox snake were observed during the biological survey.

3.3.6.3 Site Wildlife

Numerous species and signs of species of wildlife were observed to be present in the Site area during the activities associated with the biological survey. Deer tracks (*Odocoileous spp.*) were noted by McLaren/Hart (1996c) in Radiological Area 2 and on the adjacent Ford property. Based on the home range of deer, it is likely that all areas of the Site are accessible to this species. Rabbits (*Sylvilagus floridanus*) or signs of rabbits were observed in Radiological Areas 1 and 2, areas surrounding the north surface water body and the Ford property. It is likely that rabbits are cosmopolitan throughout the Site. Other cosmopolitan species include red-winged black birds (*Aegialius phoeniceus*), robins (*Turdus migratorius*) and occasionally crows (*Corvus brachynchos*).

A great blue heron (*Ardea herodias*), a piscivorous bird, was observed flying above the Site and landing in the south flood control channel (McLaren/Hart, 1996c). This species is likely to use aquatic habitats both on and offsite, but it will feed only in those waters containing prey species of fish and amphibians.

Several pellets containing fur were observed in Areas 1 and 2 and a relatively large den was observed in the landfill berm along the northwest side of Area 2 (McLaren/Hart, 1996c). These pellets and the den were possibly due to coyotes (*Canis latrans*), red fox (*Vulpes*) or possibly both. The home range of these species is large enough to include the entire Site and the presence of rabbits suggests a food source for these species (McLaren/Hart, 1996c).

3.4 Subsurface Features

The subsurface conditions beneath the landfill consist of municipal refuse, construction and demolition debris, other wastes and the associated soil cover materials, alluvial deposits and limestone, dolomite and shale bedrock.

3.4.1 Landfill Deposits

The various areas of landfill activities were previously described in Section 3.2. The deposits associated with past landfilling primarily include municipal refuse, construction and demolition fill and associated soil cover. The configuration of the landfill deposits in Radiological Areas 1 and 2 and the associated radiological impacted soil

materials will be addressed as part of the discussions of source areas in Section 4 of this report.

3.4.2 Geology

The geology of the Site area consists of Paleozoic age sedimentary rocks overlying Pre-Cambrian age igneous and metamorphic rocks. The Paleozoic bedrock is overlain by unconsolidated alluvial and loess deposits of recent (Holocene) age. A generalized stratigraphic column for the St. Louis area is presented on Figure 3-9.

3.4.2.1 Bedrock Geology

The lowermost bedrock unit beneath the Site consists of Pre-Cambrian igneous and metamorphic rocks that are overlain by cherty dolomite, siltstone, sandstone and shale of Cambrian age. These deposits are overlain by approximately 2,300 feet of limestone, dolomite, shale and sandstone of Ordovician age which in turn are overlain by approximately 200 feet of cherty limestone's of Silurian age. Devonian age sandstone, limestone and shale deposits lie unconformably on the Silurian age deposits.

The uppermost bedrock units in the vicinity of the Site consist of Mississippian age limestone and dolomite with inter-bedded shale and siltstone layers of the Kinderhookian, Osagean, and Meramecian Series. The Kinderhookian Series is an undifferentiated limestone, dolomitic limestone, shale and siltstone unit ranging in thickness from 0 to 122 feet in the St. Louis area. The Osagean Series consists of the Fern Glen Formation, a red limestone and shale, and the Burlington-Keokuk Formation, a cherty limestone. The Fern Glen Formation ranges in thickness from 0 to 105 feet and the Burlington-Keokuk Formation ranges from 0 to 240 feet thick in the St. Louis Area.

The Meramecian Series overlies the Osagean Series rocks. The Meramecian Series consists of several formations including the Warsaw Formation, the Salem Formation, the St. Louis Formation, and the St. Genevieve Formation.

Pennsylvanian-age Missourian, Desmoisian, and Atokan formations are present in some areas above the Mississippian-age rocks. The Pennsylvanian-age rocks consist primarily of shale, siltstone, and sandstone with silt and clay. These formations range in combined thickness from 0 to 375 feet in this area. The Atokan-Series Cheltenham Formation was identified as being present in the landfill soil borrow area located in the southeastern corner of the Site.

3.4.3 Hydrogeology

The hydrogeology of the Site is dominated by a water table aquifer contained within the alluvial materials beneath the Site and minor groundwater present in fractures and solution cavities and the primary porosity of the limestone and dolomite bedrock units beneath the Site.

3.4.3.1 Regional Hydrogeology

Groundwater is present in both the bedrock units and the unconsolidated materials. The major bedrock aquifers of the St. Louis area include the Cambrian-age Potosi Dolomite and the Ordovician-age Gasconade Dolomite, Roubidoux Formation and St. Peter Sandstone.

The Potosi Dolomite can be present in thicknesses of up to 324 feet at an average depth of 2,240 feet in the St. Louis area. The Gasconade Dolomite and the associated Gunter Sandstone occur in thickness of up to 280 feet in the St. Louis area. These units are overlain by the Roubidoux Formation which ranges from 0 to 177 feet thick in the St. Louis area. The average depth of the Roubidoux Formation is approximately 1,930 feet. The St. Peter Sandstone lies at a depth of approximately 1,450 feet below ground surface and can be as much as 160 feet thick. It should be noted that the thickness and depth of these formations vary throughout the St. Louis area, and they may not be present in some places. Due to their depth, these formations are generally not used as a source of potable water. The deeper Cambrian and Ordovician-age aquifers are separated from shallower units by the Ordovician-age Maquoketa shale that appears to provide confinement for the underlying deeper aquifers.

Miller et al. (1974) describes the uppermost regional aquifers present in the Silurian, Devonian, Mississippian and Pennsylvanian- age rocks, as yielding small to moderated quantities of water ranging from 0 to 50 gpm. The Mississippian-age Mermecian Series rocks (including the Warsaw, Salem and St. Louis Formations), that underlie and are present immediately to the west of the Site, are not identified as favorable for groundwater development due to their generally low yield (less than 50 gallons per minute [gpm]) (Miller et al., 1974).

The major alluvial aquifers in the area are differentiated to include the Quaternary-age alluvium and the basal parts of the alluvium underlying the Missouri River floodplain. These floodplain alluvial aquifers are typically exposed to the surface and can be as much as 150 feet thick (Miller et al., 1974). Alluvial wells completed in the Mississippi and Missouri River floodplains are capable of yielding more than 2,000 gpm (Emmett and Jeffery, 1968).

3.4.3.2 Water Supply Wells in the Vicinity of the Site

No public water supply wells within the vicinity of the Site obtain any water from the alluvial aquifer (Foth & Van Dyke, 1989). Twenty-six private water supply wells were identified in 1989 within a three mile radius of the Site (Foth & Van Dyke, 1989). None of the wells located within a 1-mile radius of the Site are used as a drinking water source (Foth & Van Dyke, 1994). The distribution of private wells in the vicinity of the Site is as follows:

- Four wells are located less than one mile from the Site; however, two no longer exist and the remaining two are not used as drinking water sources. Their uses are discussed below;
- Seventeen wells located between one and two miles from the Site including four wells used for irrigation purposes, one well at an abandoned Site, and twelve wells used as drinking water sources; and
- Five wells located between two and three miles from the Site, all of which are used as drinking water sources.

The two private groundwater wells within one mile of the Site are used for monitoring and commercial purposes, and neither are used as a drinking water source (Foth & Van Dyke, 1994). These include the private well located at the Old Bridge Bait Shop that is 5,100 feet northwest from the Site boundary and a private "shop well" located 4,600 feet northeast from the Site boundary (Figure 3-10). The nearest well reportedly used as a drinking water source is located approximately 5,300 feet to the north of the Site (Figure 3-10). The number of private wells has likely decreased since 1989 due to urban and suburban development and flooding of the area in 1993 and 1995.

3.4.3.3 Site Hydrogeology

The Site is located on the eastern edge of the historic Missouri River Valley along the transition between the alluvial floodplain to the west and the loess bluffs to the east. Radiological Areas 1 and 2 are underlain by alluvial deposits of varying thickness. The landfill debris varies in thickness from 5 to 56 feet, with an average thickness of approximately 36 feet in Area 1 and approximately 30 feet in Area 2. The underlying alluvium increases in thickness from east to west beneath Area 1. The alluvial thickness beneath the southeastern portion of Area 1 is less than 5 feet (bottom elevation of 420 feet AMSL) while the thickness along the northwestern edge of Area 1 is approximately 80 feet (bottom elevation of 370 feet AMSL). The thickness of the alluvial deposits beneath Area 2 is fairly uniform at approximately 100 feet (bottom elevation of 335 feet AMSL).

During the RI investigations, groundwater was generally encountered in the underlying alluvium near or immediately below the base of the landfill debris. Isolated bodies of perched water were encountered in two of the 24 soil borings drilled in Area 1 and six of the 40 soil borings drilled in Area 2 as part of the RI field investigations. The perched water generally occurs in small isolated units at depths varying from five to 30 feet below ground surface (Figure 3-11).

Groundwater flow beneath Radiological Areas 1 and 2 occurs in the underlying alluvium and is influenced by 1) dewatering effects associated with the former limestone quarry and the current leachate collection activities, 2) infiltration and localized ponding of storm water on the surface of the landfill, 3) infiltration through various drainage ditches located on and off of the Site, and 4) the flood control channel located on the western margin of Area 2.

Monthly groundwater levels were measured in various wells during the first year of the RI investigations and on a quarterly basis during the second year. The depth to water measurements and resulting groundwater elevation data is included in Appendix A. These data indicate that with the exception of the localized perched water conditions encountered in isolated areas within the landfill, groundwater generally occurs only in the underlying alluvium at or below the base of the landfill materials. Depths to groundwater vary from 15 to 20 feet at the offsite locations, where no filled materials are present, and up to 60 feet at locations inside the Site boundaries. Groundwater elevations varied seasonally and were generally lowest during the fall and winter months (September through March) and highest during the spring and summer months (April through August).

The RI data indicate that only a very small amount of relief (less than one foot) exists in the water table surface beneath the landfill. Based on the water level data, the inferred direction of groundwater flow beneath Area 1 is to the south toward the active landfill. Presumably this flow is in response to the active dewatering and leachate collection activities conducted in conjunction with the landfill operations.

Aquifer testing consisting of slug tests was performed on 18 wells located throughout the Site to assess the hydraulic conductivity of the underlying alluvium. Testing was performed on six shallow alluvial wells (wells completed near the top of the alluvial materials immediately below the landfill materials), six intermediate wells and six deep wells (wells completed near the base of the alluvium near the bedrock contact). Results of the aquifer testing indicated that the alluvial materials possess hydraulic conductivity values on the order of 3×10^{-2} centimeters per second (cm/sec) ranging from 8.76×10^{-4} to 8.85×10^{-2} cm/sec. Although the amount of available data is limited, these results indicate that the hydraulic conductivity values are slightly greater in the lower portions of the alluvium. The results of the aquifer testing are summarized in Appendix A.

Table 3-1 : Plant Species Identified at the West Lake Landfill

Scientific Name	Common Name	Area 1	Area 2	North Flood Control Channel	West Flood Control Channel	Ford Property
Trees/Shrubs						
<i>Acer negundo</i>	Box elder		X			X
<i>Cercis canadensis</i>	Red Bud		X			
<i>Cornus amomum</i>	Silky dogwood		X	X		
<i>Fraxinus spp.</i>	Ash		X	X		
<i>Morus spp.</i>	Mulberry		X			
<i>Populus deltoides</i>	Eastern Cottonwood		X	X		X
<i>Rhus typhina</i>	Staghorn Sumac		X	X		X
<i>Salix amygdaloides</i>	Peaches-leaved willow		X			
<i>Salix spp.</i>	Willow		X	X		
Woody Vines						
<i>Toxicodendron radicans</i>	Poison Ivy		X	X		X
<i>Vitis spp.</i>	Grape		X	X		X
Herbs and Grasses						
<i>Andropogon spp.</i>	Bluestem	X				
<i>Amarosia spp.</i>	Ragweed					X
<i>Asclepias syriaca</i>	Common milkweed		X			
<i>Carduus crispus</i>	Nodding thistle	X	X			X
<i>Daucus carota</i>	Wild carrot		X			
<i>Erigeron annuus</i>	Daisy fleabane		X			X
<i>Gallium spp.</i>	Bedstraw		X	X		
Graminae	Unknown Grasses	X	X	X	X	X
<i>Imbricaria capensis</i>	Jewelweed		X			
<i>Juncus spp.</i>	Rush	X				
<i>Medicago alba</i>	White sweet clover		X			
<i>Onunka comorensis</i>	Prickly pear		X			
<i>Phytolacca americana</i>	Pokeweed		X	X		
<i>Plantago major</i>	Common plantain	X				X
<i>Polygonum spp.</i>	Smartweed					X
<i>Rumex crispus</i>	Curled-dock	X	X			X
<i>Solidago spp.</i>	Goldenrod	X	X			X
<i>Setaria spp.</i>	Foxtail	X	X			X
<i>Thlaspi arvense</i>	Field pennycress	X	X			X
<i>Trifolium pratense</i>	Red clover		X			
<i>Trifolium procumbens</i>	Yellow sweet clover		X			X
<i>Typna spp.</i>	Cattails	X	X			
<i>Vicia cracca</i>	Cow vetch		X			X

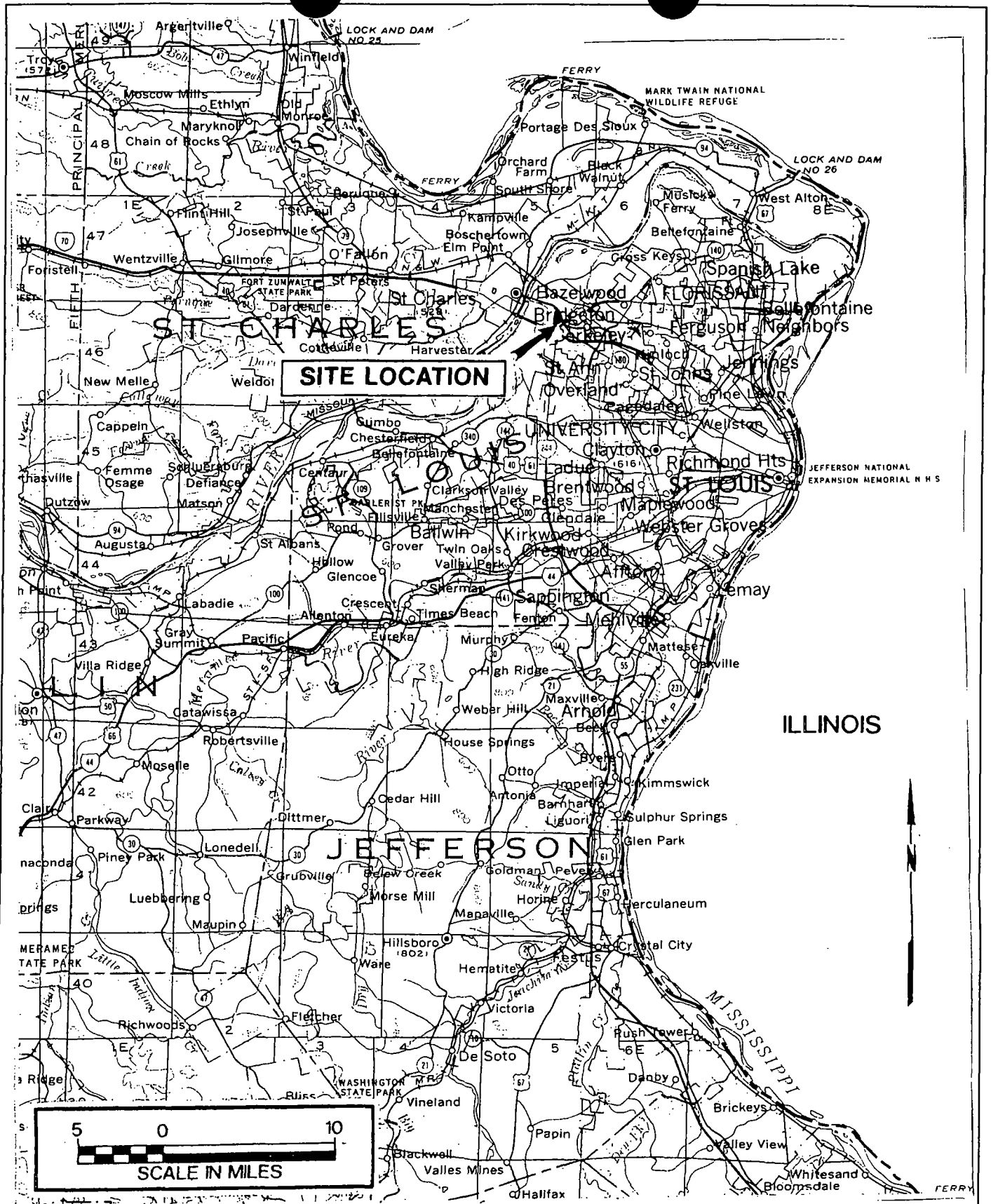
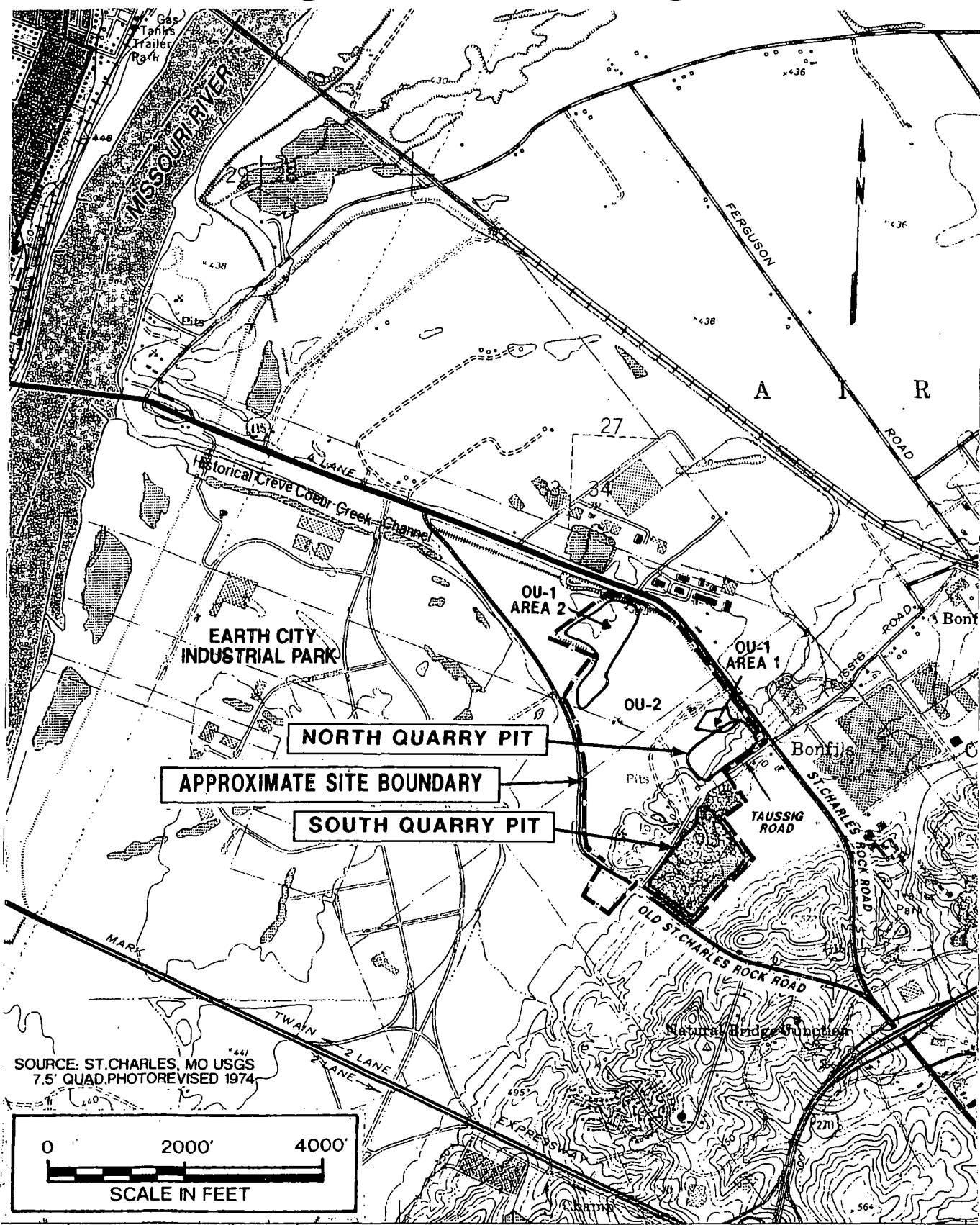
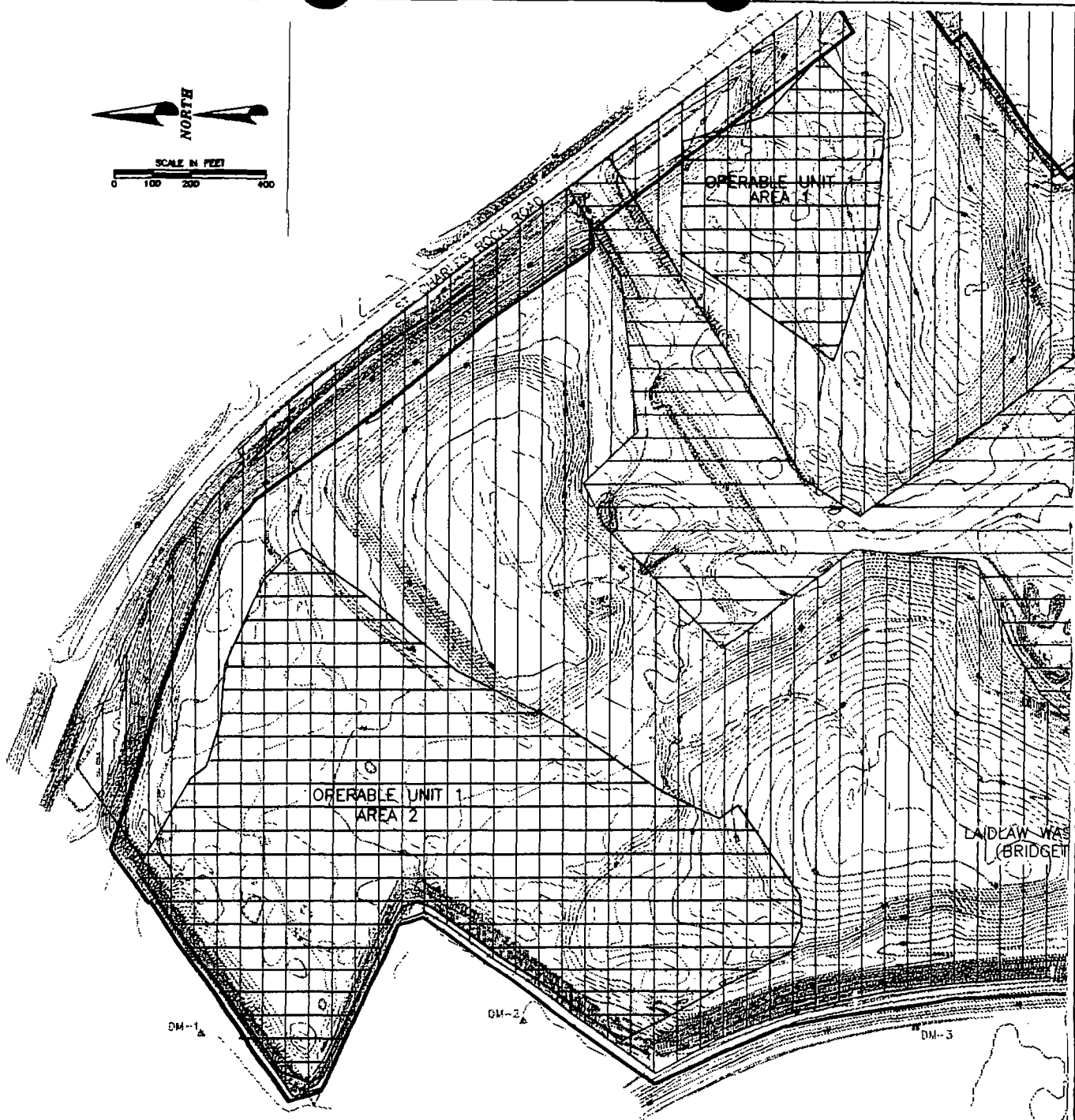
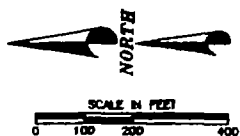





Figure 3-1: Site Vicinity Map
(modified from Golder Associates, 1996, Figure 1-1)





LEGEND

-  LAIDLAW WASTE SYSTEMS (BRIDGETON) INCORPORATED
-  WEST LAKE QUARRY AND MATERIAL COMPANY
-  ROCK ROAD INDUSTRIES, INC.

SOURCE: LAIDLAW WASTE SYSTEMS, INC.

TOPOGRAPHY NORTH OF OLD ST. CHARLES ROCK ROAD: FEBRUARY 1994

TOPOGRAPHY SOUTH OF OLD ST. CHARLES ROCK ROAD: FEBRUARY 1992

Figure 3-3: Site Ownership In Vicinity of Area 1 and Area 2
(modified from Golder Associates, 1996, Figure 1-4)

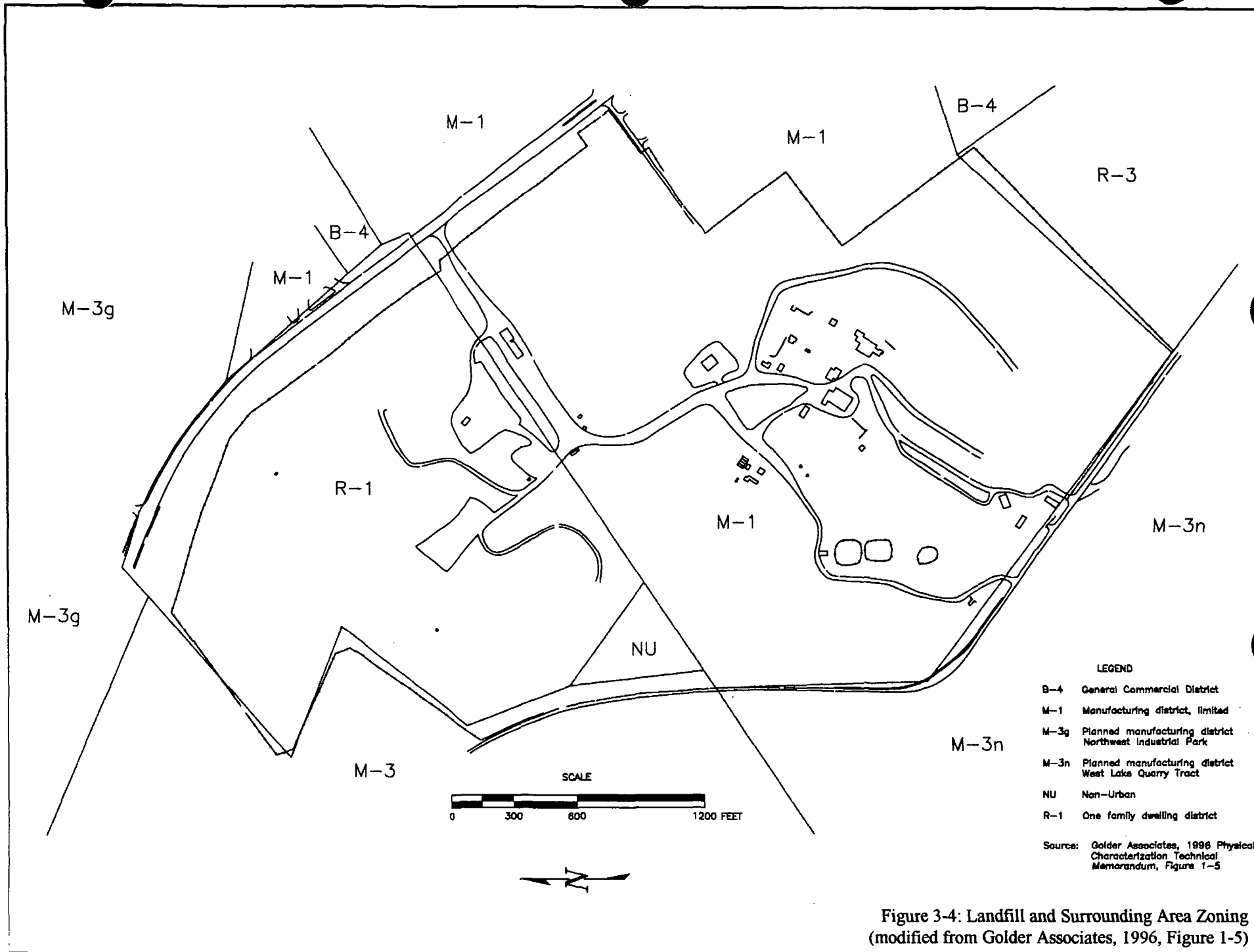


Figure 3-4: Landfill and Surrounding Area Zoning
(modified from Golder Associates, 1996, Figure 1-5)

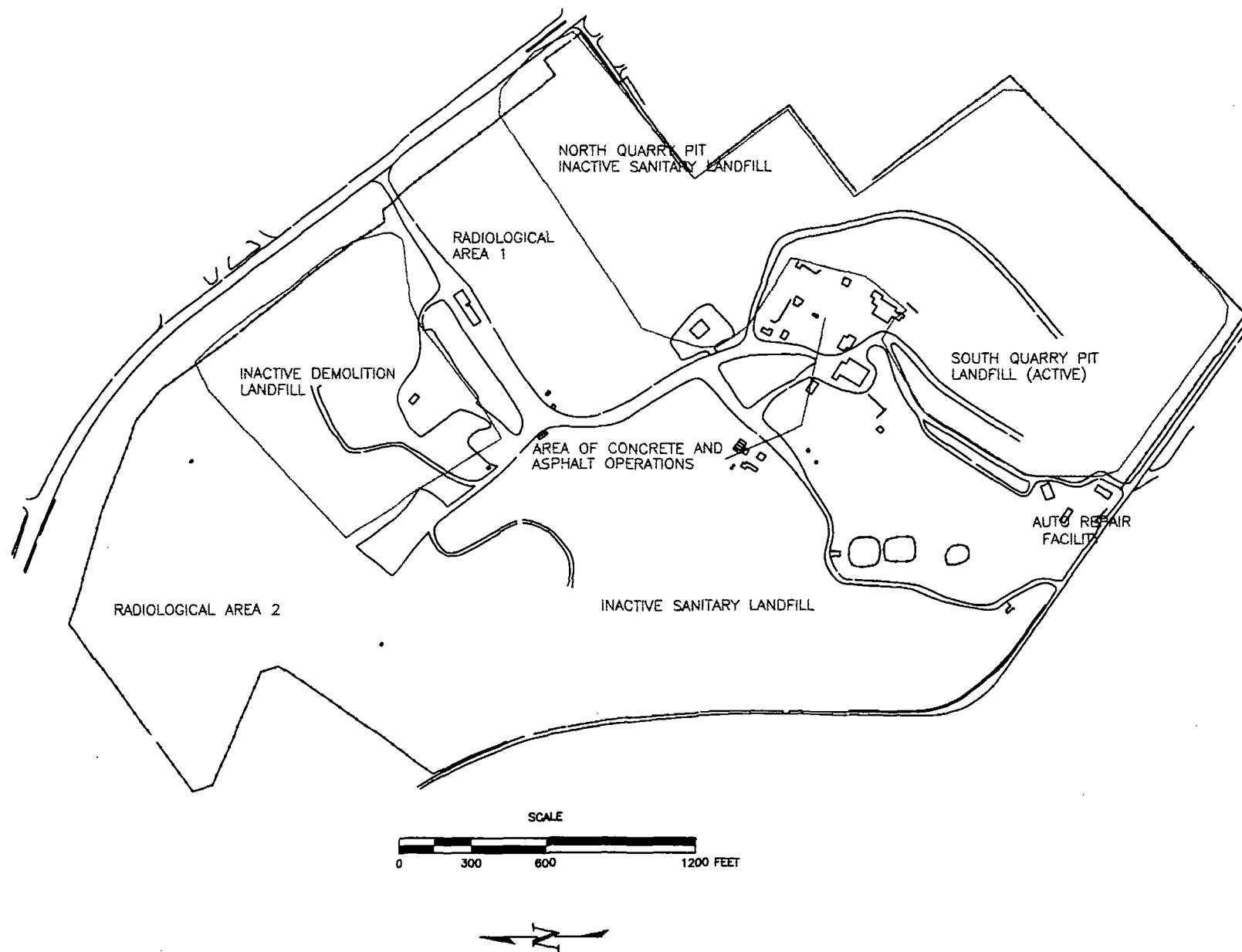


Figure 3-5 Areas of Landfill Operations

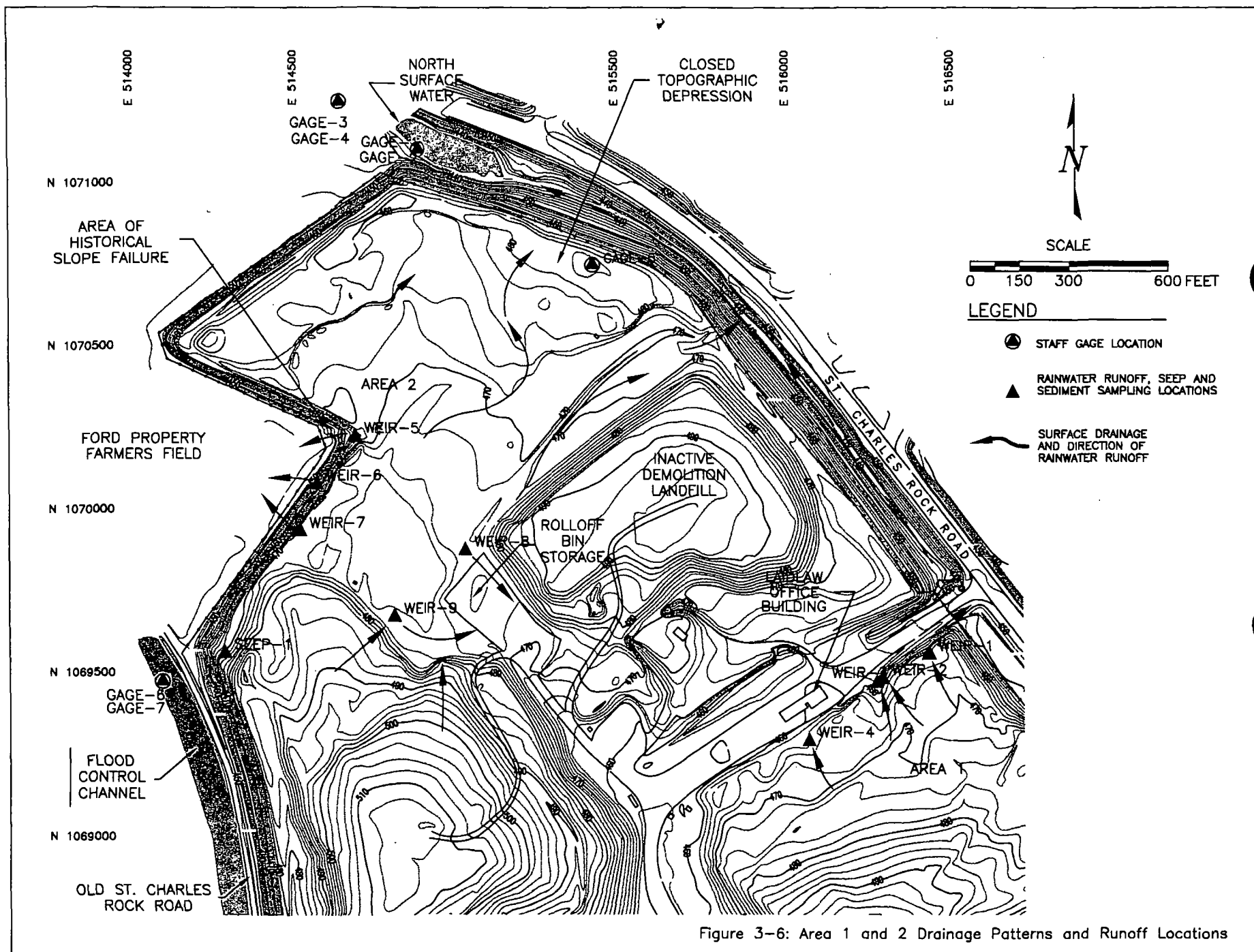
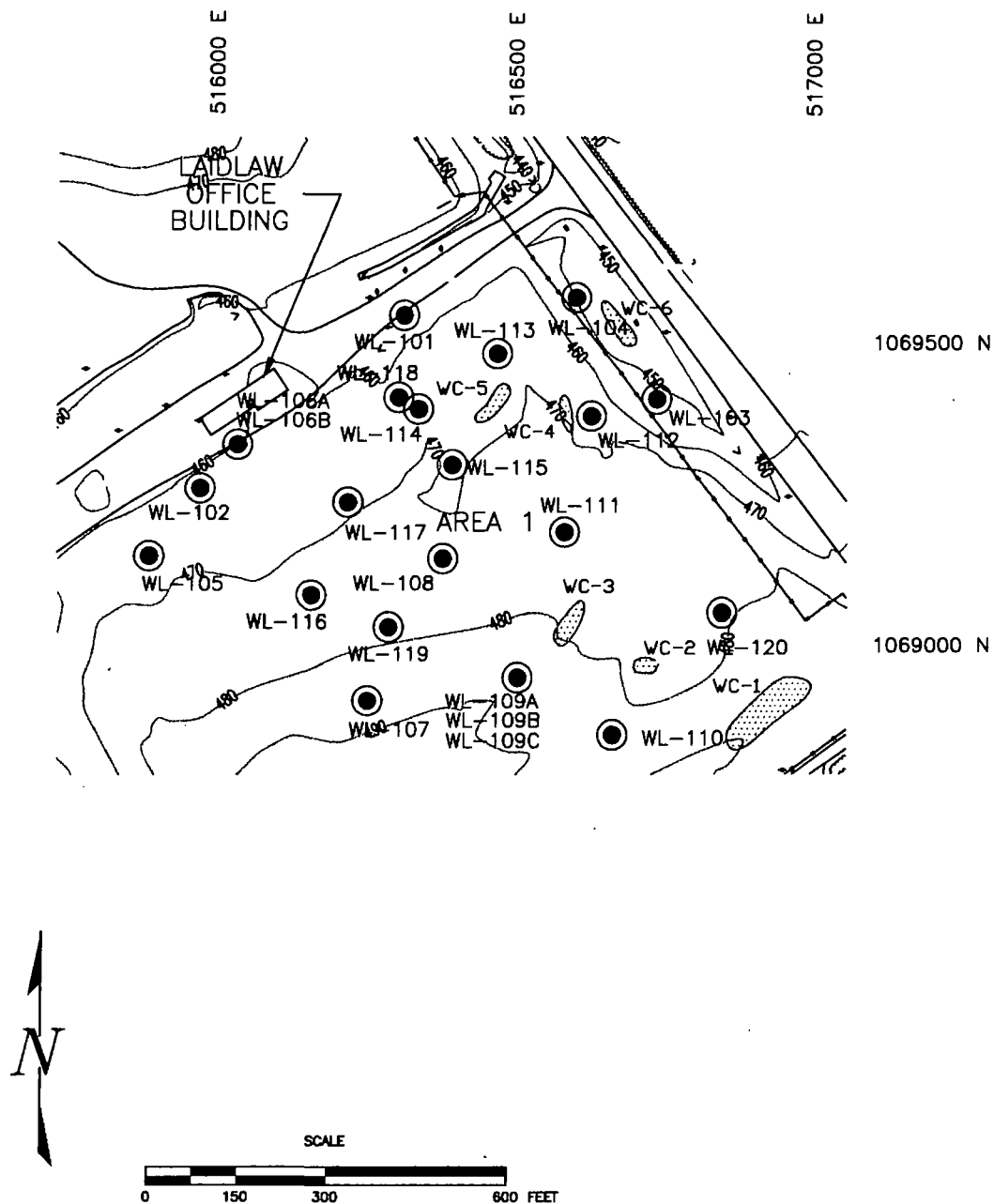


Figure 3-6: Area 1 and 2 Drainage Patterns and Runoff Locations



LEGEND



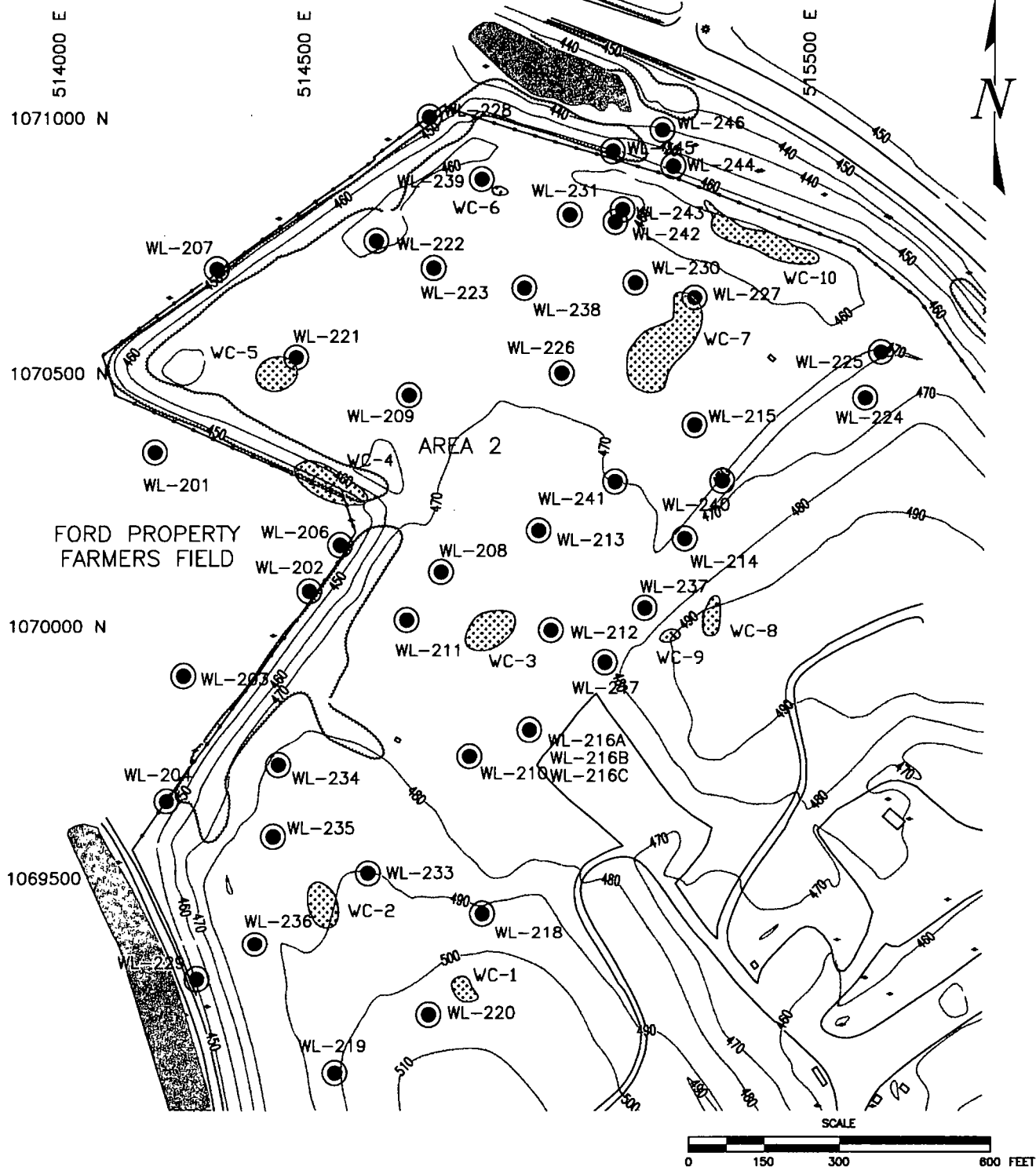
- WL-107  REMEDIAL INVESTIGATION SOIL BORING LOCATION
- WC-1  HYDROPHILIC VEGETATION

Figure 3-7 Hydrophilic Vegetated Communities in Area 1



LEGEND

WL-207 REMEDIAL INVESTIGATION SOIL BORING LOCATION

WC-1 HYDROPHILIC VEGETATION

Figure 3-8: Hydrophilic Vegetated Communities in Area 2

System	Series	Group	Formation	Thickness (feet)	Dominant Lithology	Water-Bearing Character
Quaternary	Illinoian		Alluvium	0-150	Sand, gravel, silt, and clay.	Some wells yield more than 2,000 gpm.
	Pleistocene		Loess Glacial Till	1-110 0-35	Silt Pebbly clay and silt.	Essentially not water yielding.
Pennsylvanian	Missourian	Pittston	Undifferentiated	0-75	Shales, siltstones, "dirty" sandstones, coal beds and thin limestone beds.	Generally yields very small quantities of water to wells. Yields range from 0-10 gpm.
	Desmoinesian	Marmaton	Undifferentiated	0-90		
		Cherokee	Undifferentiated	0-200		
	Asolan		Chetumham Formation	Unknown		
Mississippian	Meramecian		Sq. Geopline Formation	0-160	Argillaceous to arenaceous limestone.	Yields small to moderate quantities of water to wells. Yields range from 5 to 50 gpm. Higher yields are reported for this interval locally.
			St. Louis Limestone	0-180		
			Salem Formation	0-180		
			Warsaw Formation	0-110		
	Osagean		Burlington-Kentut Limestone	0-240	Cherty limestone	
			Fern Glen Formation	0-105	Red limestone and shale.	
	Kinderhookian	Chouteau	Undifferentiated	0-122	Limestone, dolomitic limestone, shale and siltstone.	
Devonian	Upper	Sulphur Springs	Rushberg Sandstone	0-60	Limestone and sandstone	
			Glen Park Limestone			
			Grassy Creek Shale	0-50	Fossiliferous, carbonaceous shale	
Silurian			Undifferentiated	0-200	Cherty Limestone	
Ordovician	Cincinnatian		Maquoketa Shale	0-163	Silty, calcareous or dolomitic shale.	Probably constitutes a confining influence on water movement.
			Cape Limestone	0-5	Argillaceous limestone.	Yields small to moderate quantities of water to wells. Yields range from 3 to 50 gpm. Decorah Formation probably acts as a confining bed locally.
	Champlainian		Kinross Limestone	0-145	Massive limestone	
			Decorah Formation	0-50	Shale with interbedded limestone	
			Plattin Formation	0-240	Finely crystalline limestone	
			Rock Ledge Formation	0-93	Dolomite and limestone, some shale.	
			Irachin Dolomite	0-135	Primarily argillaceous dolomite.	
			St. Peter Sandstone	0-160	Silty sandstone, cherty limestone grading upward into quartzite sandstone	
			Everton Formation	0-130		Yields moderate quantities of water to wells. Yields range from 10-140 gpm.
	Canadian		Powell Dolomite	0-150	Sandy and cherty dolomites and sandstone	Yields small to large quantities of water to wells. Yields range from 10 to 300 gpm. Upper part of aquifer group yields only small amounts of water to wells.
			Cotter Dolomite	0-320		
			Jefferson City Dolomite	0-225		
			Roubidoux Formation	0-177		
			Gasconade Dolomite Gunter Sandstone Member	0-280		
Cambrian	Upper	Elvina	Emmence Dolomite	0-172	Cherty dolomites, siltstones, sandstone, and shale.	Yields moderate to large quantities of water to wells. Yields range from 10 to 400 gpm.
			Potomac Dolomite	0-325		
			Derby-Dorcas Dolomite	0-165		
			Davis Formation	0-150		
Precambrian					Igneous and metamorphic rocks.	Does not yield water to wells in this area.

NOTES: Basal part of alluvium may be Pleistocene age.
Stratigraphic nomenclature may not necessarily be that of the U.S. Geological Survey.
Aquifers most favorable as water sources are shaded.
Double line indicates unconformity.

SOURCE: *Water Resources of the St. Louis Area, Missouri. (Miller et al., 1974).*

Figure 3-9: Generalized Stratigraphic Column for the St. Louis Area
(from Golder Associates, 1996, Table 2-1)

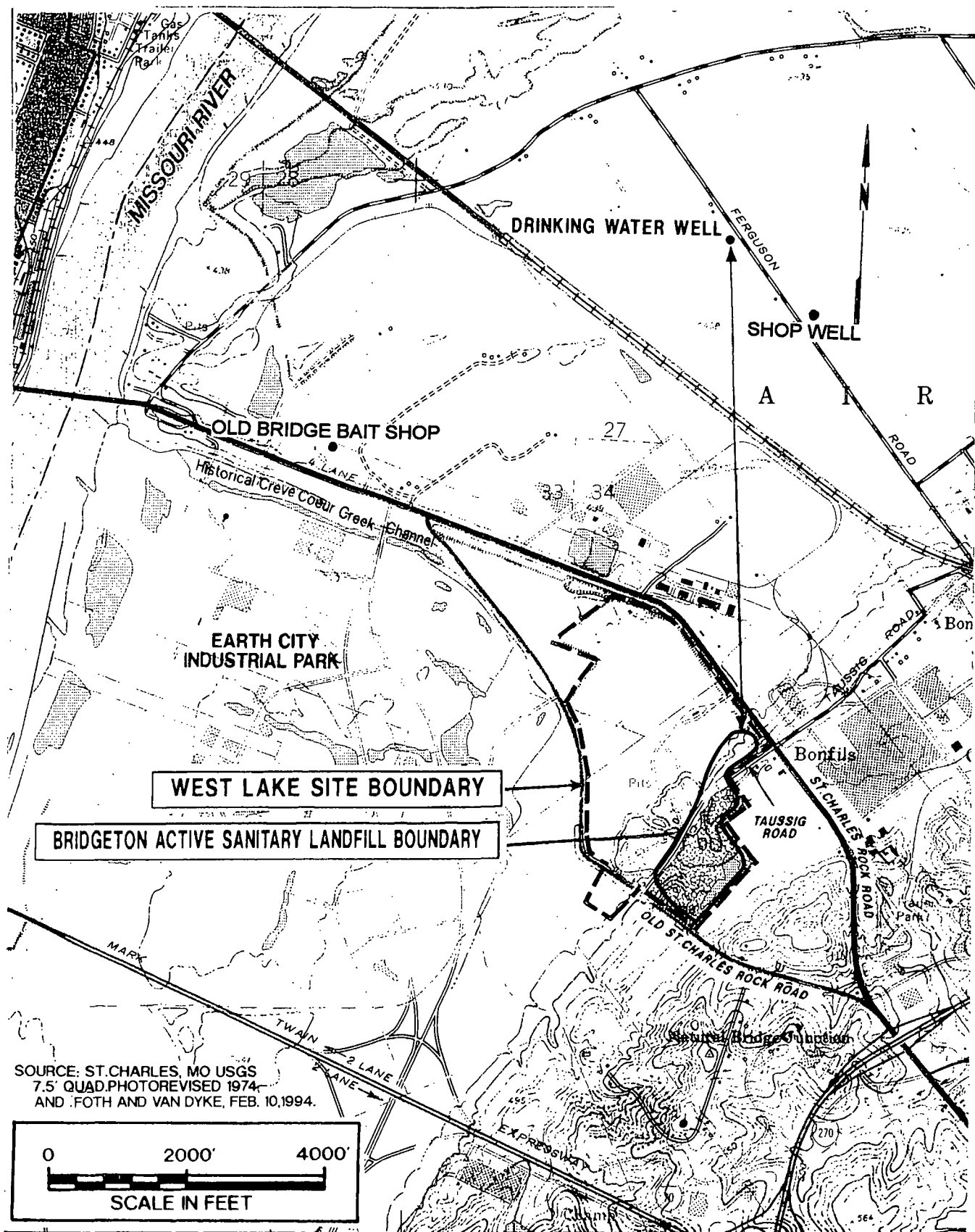


Figure 3-10: Locations of Water Supply Wells in the Vicinity of the Site
(modified from Golder Associates, 1996, Figure 2-1)

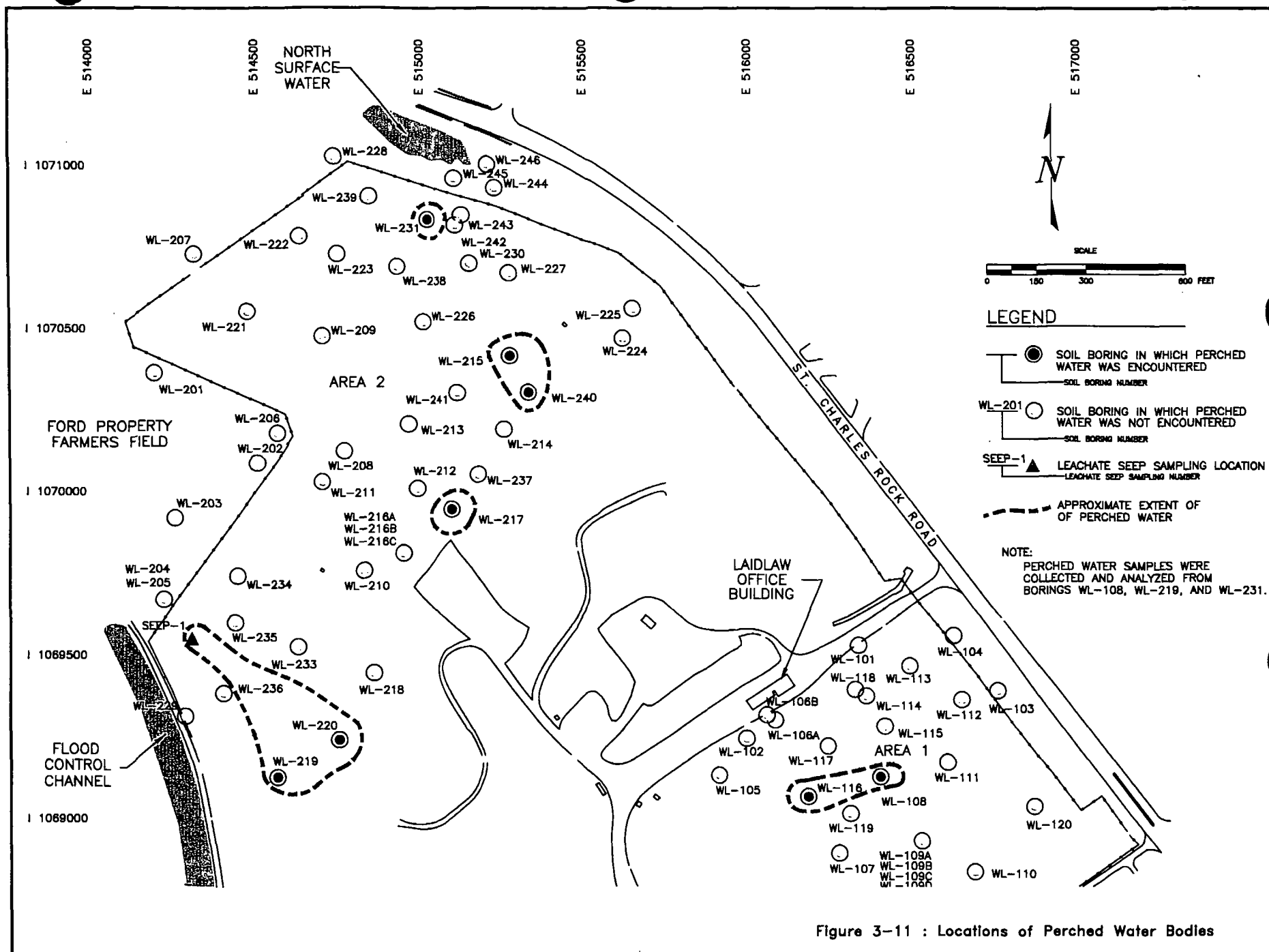


Figure 3-11 : Locations of Perched Water Bodies

4. SOURCE DISTRIBUTION

This section summarizes the location, extent and composition of the materials that could act as a source of radionuclides to the potential transport pathways (source materials) in Area 1 and Area 2. Generally, review of the boring log data indicates that the distribution of radiological materials are interspersed and interlayered within the solid waste. Figure 4.1 summarizes the approximate extent of radionuclides exposed at the surface based upon concentrations of radionuclides above surface reference levels. Figure 4.2 summarizes the approximate extent of radionuclides in the subsurface based on concentrations of radionuclides above subsurface reference levels, down-hole gamma readings with maximum peaks at or above 6,000 counts per minute, the overland gamma survey results, and radon levels in excess of standards (see discussion below).

Tables 4-1 through 4-4 summarize the calculated background value, the number of borings with samples containing radiological levels above background levels but below the reference levels and the number of borings with samples containing radiological levels above the reference levels for the surface samples in Area 1 (Table 4-1), the subsurface samples in Area 1 (Table 4-2), the surface samples in Area 2 (Table 4-3) and the subsurface samples in Area 2 (Table 4-4). Complete summaries of all data are in Appendix A. The background levels were calculated by McLaren/Hart from values measured at four background sampling locations. Two of these locations were between 1,200 and 1,500 feet south of the southeastern corner of the Site in the borrow area for the existing active landfill. One sample was collected from the Ford property west of the Site. The final sample was collected north of the landfill on the northern side of St. Charles Rock Road. These tables summarize the range of radionuclides found in the source materials from Area 1 and Area 2 and provide an indication of the frequency individual radionuclides exceed the set background and resulting reference levels.

For purposes of these tables and the ensuing discussions, the reference levels are based on the EPA "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings" as set forth in Title 40, Part 192, Sections 12 and 41. These standards state that:

The concentration of radium-226 (or radium-228) in land averaged over any area of 100 square meters shall not exceed the background level by more than - (1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and (2) 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface.

These standards are only applicable to uranium and thorium mill tailings sites, and no evaluation of potentially applicable or relevant and appropriate requirements (ARARs) has been completed for the West Lake Site. However, in the absence of any established applicable standards, these values are included as a point of reference solely for use during

the initial evaluation of the Site investigation data. In addition, although the EPA standards are only applicable to radium-226 and radium-228, they have also been utilized in the tables in this section to assist in the evaluation and summary of the occurrences of the other radionuclides detected in both Area 1 and Area 2. Standards appropriate for use at this Site will be developed as part of the BRA.

4.1 Source Distribution in Area 1 Soils

The boundaries of Area 1 have been defined based on the results of the overland gamma survey, the down-hole radiological logging effort and the collection and analysis of soil samples from various soils borings. The radiological activity defined by the soils borings, borehole logging, and soil sample analysis program is generally within the overland gamma survey boundaries for Area 1.

4.1.1 Area 1 Surface Source Distribution

Only two of the nine surface samples in Area 1 contained radionuclides with activities above the reference levels (Figure 4-1). These two samples were obtained from borings WL-106 and WL-114. It should be noted that the analytical results from the soil samples from boring WL-114 indicated that, although the surface sample contained levels of radionuclides above the surface reference levels, the down-hole gamma log indicated that the highest gamma activity occurred at a depth of 4 to 5 feet. Boring WL-114 was thus included within the boundaries of both the surface and the subsurface areas of affected materials.

The approximate region in Area 1 containing locations with surface soil sample analytical results above surface reference levels or down-hole radiological logs with gamma readings with maximum peaks at or above 6,000 counts per minute is shown on Figure 4-1. This area includes approximately 88,900 square feet. Based upon a 6 inch depth that is consistent with the definition of surface materials in the EPA uranium and thorium mill tailings standards discussed above, the surface materials including both the impacted soils that are acting as a source and the associated refuse, debris, and fill materials are estimated at 44,400 cubic feet or 1,640 cubic yards. Assuming a solid waste density of 800 pounds per cubic yard (Tchobanoglous et al., 1977), this volume would equate to approximately 650 tons.

The radon flux measurement activities completed by EMSI in June 1997 and discussed in detail in Section 5.1.1 below indicated that two sample locations had measured radon flux levels above the 20 pCi/m²s standard for radon emissions from the disposal of uranium mill tailings as promulgated in 40 CFR Part 61. As discussed above for the reference levels, these standards are only applicable to uranium mill tailings sites. No evaluation of potentially applicable or relevant and appropriate requirements (ARARs) has

been completed for the Site. Although the EPA standard is only applicable to uranium mill tailings, it is referenced in this report to assist in the evaluation of the significance of the radon flux measurement results.

Both of the locations where radon flux values were measured above the uranium mill tailing standard were inside of the boundary defined by the soil samples, overland gamma survey and down-hole gamma logs, so no additional area was added to the boundaries shown on Figure 4-1.

4.1.2 Area 1 Subsurface Source Distribution

Area 1 contains two sub-areas that contain radiological materials at two differing depths. In the northeastern part of Area 1, an area contains radiological materials at a general depth between 5 and 7 feet, although deeper intervals are present near borings PVC-28 and PVC-38 (Figure 4-2). The second area where radiological material is present at depth is in the southwestern part of Area 1. This area generally contains radiological materials at a depth between 0 and 5 feet (Figure 4-2).

Figure 4-2 displays the borings with subsurface samples containing radionuclides above the subsurface reference levels in Area 1. A total of four borings (WL-105, WL-106, WL-114, and WL-118) consistently contained radionuclide levels above the reference levels. Two additional borings, WL-112 and WL-117, contained levels of thorium-230 above reference levels. The levels of the other radionuclides in the samples from these two borings were less than the reference levels but they generally did exceed background levels so these two borings were also assumed to represent areas exceeding the reference levels.

Figure 4-2 shows the approximate region of the subsurface materials that are acting as a potential source to the migration pathways in Area 1. This area was delineated based on the surface soil sample analytical results that included radionuclides above the subsurface reference levels or the results of down-hole radiological logging that showed gamma readings with maximum peaks at or above 6,000 counts per minute in the borings, or both. This area includes approximately 198,000 square feet. An average thickness of 8.33 feet was derived for these materials from the eight borings containing intervals with down-hole gamma readings with maximum peaks at or above 6,000 counts per minute as shown on Figure 4-2. Based upon the above surface area and average thickness, the volume of potential source materials is estimated at 1,650,000 cubic feet or 61,000 cubic yards. This volume includes both the impacted soil and the associated refuse, debris, and fill materials. Assuming a solid waste density of 800 pounds per cubic yard (Tchobanoglous et al., 1977), this volume would equate to approximately 24,400 tons.

The two locations described in Section 4.1.1 above with the radon flux measurements exceeding 20 pCi/m²s were within the subsurface boundaries as shown on

Figure 4-2; therefore, incorporation of the radon data does not change the volume of mass estimated for the subsurface materials.

4.2 Source Distribution in Area 2 Soils

The boundaries of Area 2 have been defined based on the results of the overland gamma survey, the down-hole radiological logging effort and the collection and analysis of soil samples from various soils borings. The radiological activity defined by the soils borings, borehole logging, and soil sample analysis program is generally within the overland gamma survey boundaries for Area 2.

4.2.1 Area 2 Surface Source Distribution

Only three of the 15 surface soil samples (ten from drilled borings and five from hand auger borings) consistently displayed radionuclide levels above the reference levels (Figure 4-1). These locations include the surface samples obtained at the locations of soil borings WL-206, WL-209 and WL-210. In addition to these three locations, the surface sample from hand auger boring WL-243 displayed levels of thorium-230, lead-210 and protactinium-231 above surface reference levels. Only the thorium-230 values from this boring was substantially above the surface reference level.

Five additional surface soil locations (soil borings WL-213, WL-222, and WL-235 and hand auger borings WL-242 and WL-244) displayed levels of thorium-230 above the surface reference levels. In the surface sample from boring WL-222, the thorium-230 decay products were detected at levels just slightly above background levels but less than reference levels. The area defined by hand borings WL-242, WL-243 and WL-244 was not included inside the boundaries of the area of surface materials exceeding reference standards because it appears to be associated with deposition of runoff sediments rather than surface exposure of in-place material. Moreover, the down-hole logs from the borings southwest of these hand borings did not exhibit gamma readings with maximum peaks at or above 6,000 counts per minute at depths shallower than 3 feet.

The radon flux measurement activities completed by EMSI in June 1997 indicated that only two sample locations in Area 2 had measured flux levels above the 20 pCi/m²s standard for radon emissions for uranium and thorium mill tailings (WL-209 and WL-223, Figure 4-1). Based upon the radon flux reading from boring WL-223 and the presence of thorium-230 above surface reference levels, the boundary for surface exposure of radionuclides was drawn to include this region.

The approximate region in Area 2 containing locations with surface soil sample analytical results above surface reference levels or locations with down-hole radiological logs with gamma readings with maximum peaks at or above 6,000 counts per minute, or locations with radon flux emissions above 20 pCi/m²s is shown on Figure 4-1. This area is approximately 504,000 square feet. Based upon a 6 inch depth that is consistent with the

definition of surface materials in the EPA uranium and thorium mill tailings standards discussed above, the surface materials including refuse, debris, and fill materials that are acting as a source are estimated at 252,000 cubic feet or 9,300 cubic yards. This volume includes both the impacted soil and the associated refuse, debris, and fill materials. Assuming a solid waste density of 800 pounds per cubic yard (Tchobanoglous et al., 1977), this volume would equate to approximately 3,700 tons.

4.2.2 Area 2 Subsurface Source Distribution

Area 2 also includes two sub-areas that contain radiological materials at two differing depths. In the northern part of Area 2, an area contains radiological materials at a general depth between 3 and 7 feet, although radionuclide concentrations above subsurface reference levels were present in this sub-area to a depth of 9 feet at boring PVC-19. The second area where radiological material is contained at depth is in the southern part of Area 2. This second area generally contains radiological materials at depths between 0 and 10 feet.

Figure 4-2 displays the locations of the borings with subsurface samples that contained radionuclides above subsurface reference levels in Area 2. A total of four of the 45 soil borings in Area 2 had subsurface samples that consistently contained radionuclide levels above the reference levels. These borings include WL-209, WL-210, WL-216, and WL-234.

Two other borings (WL-211 and WL-241) also contained subsurface levels of lead-210 above its reference level. Subsurface samples from twelve borings reportedly contained levels of thorium-230 above the subsurface reference levels. These locations included WL-208, WL-211, WL-212, WL-214, WL-222, WL-226, WL-227, WL-230, WL-231, WL-233, WL-241, and WL-242 (hand boring sample from 2 feet). The boundary defining the extent of subsurface radiologically-affected materials was drawn to include all of these borings.

The two locations with radon flux measurements above 20 pCi/m²s (WL-209 and WL-223) were within the boundaries shown on Figure 4-2; therefore incorporation of the radon flux data does not change the volume of mass estimated for the subsurface materials.

The approximate limit in Area 2 containing locations with either subsurface soil sample analytical results above subsurface reference levels or down-hole radiological logs with gamma readings with maximum peaks at or above 6,000 counts per minute is shown on Figure 4-2. This area includes approximately 785,000 square feet. An average thickness of 4.25 feet was derived for these materials from the 15 borings containing intervals with down-hole gamma readings with maximum peaks at or above 6,000 counts per minute as shown on Figure 4-2. Based upon the above surface area and average thickness, the volume of potential subsurface source materials is estimated at 3,340,000

cubic feet or 124,000 cubic yards. This volume includes both the impacted soil and the associated refuse, debris, and fill materials. Assuming a solid waste density of 800 pounds per cubic yard (Tchobanoglous et al., 1977), this volume would equate to approximately 49,600 tons.

4.2.3 Ford Property Source Distribution

Borings WL-201 through WL-206 were advanced by McLaren/Hart to characterize the Ford property northwest of Area 2. Eight additional locations were sampled by EMSI during May 1997 (locations FP-1 through FP-8 on Figure 4-3).

Table 4-5 summarizes the analytical results. The data indicate that thorium-230, radium-226, lead-214, bismuth-214, lead-210, protactinium-231, actinium-227, radium-223, and thorium-232 are all present in the surface sample from WL-206 at activities above the surface reference levels. Thorium-230 is present in the surface samples above the reference level at locations FP-1, FP-5 and FP-8. Radium-226 is present in the surface sample from FP-4 above the reference level. None of the samples collected 6 inches or more below the ground surface contained any radionuclides with activities above the reference levels.

Figure 4-3 shows the assumed extent of materials containing radionuclides on the Ford property. Based upon an areal extent of 205,00 square feet and an assumed maximum depth of 6 inches, the volume of affected soil on the Ford property is estimated at 3,800 cubic yards.

Table 4-1 : Summary of Radiological Levels for Surface Materials in Area 1

Radiological Constituents	Background Value (mean + 2 std. dev.)	> Background but < Reference		Reference Levels		> Reference Level	
		# Detects	Range	Surface-subsurface		# Detects	Range
Uranium - 238 Decay Series							
Uranium-238	2.24	1	2.33	7.24	17.24	3	87-105
Thorium-234	2.76	0		7.76	17.76	1	180
Uranium-234	2.73	1	2.94	7.73	17.73	3	105-110
Thorium-230	2.45	0		7.45	17.45	3	9,700-57,000
Radium-226	1.30	1	1.53	6.30	16.30	3	906-910
Lead-214	1.13	4	1.16-1.65	6.13	16.13	3	650-1100
Bismuth-214	1.61	0		6.61	16.61	3	908-1000
Lead-210	3.77	0		8.77	18.77	4	860-1040
Uranium - 235 Decay Series							
Uranium-235/236	1.15	1	.57	6.15	16.15	3	6.86-19.5
Proactinium-231	NE	0		5.0	15.0	4	156-610
Actinium-227	NE	0		5.0	15.0	3	118-305
Radium-223	NE	4	0.87-1.16	5.0	15.0	4	113-939
Thorium - 232 Decay Series							
Thorium-232	1.55	0		6.55	16.55	4	18.1-40
Radium-228	2.37	0		7.37	17.37	0	
Thorium-228	1.33	1	1.96	6.33	16.33	0	
Radium-224	NE	1	2.95	5.0	15.0	2	1760
Lead-212	2.26	0		7.26	17.26	0	
Bismuth-212	NE	0		5.0	15.0	0	
Thallium-208	0.71	1	0.79	5.71	15.71	1	6.84

Notes: All units in pCi/g.

NE = Not established, all background samples below minimum detectable activity.

Table 4-2 : Summary of Radiological Levels for Subsurface Materials in Area 1

Radiological Constituents	Background Value (mean + 2 std. dev.)	> Background but < Reference		Reference Levels		> Reference Level	
		# Detects	Range	Surface-subsurface		# Detects	Range
Uranium – 238 Decay Series							
Uranium-238	2.24	8	2.89-6.94	7.24	17.24	3	17.8-147
Thorium-234	2.76	0		7.76	17.76	1	55.9
Uranium-234	2.73	7	2.92-15.6	7.73	17.73	1	154
Thorium-230	2.45	4	4.18-7.52	7.45	17.45	12	23.2-7853
Radium-226	1.30	12	1.31-6.3	6.30	16.30	5	18.4-128
Lead-214	1.13	16	1.14-7	6.13	16.13	5	19.1-110
Bismuth-214	1.61	8	2.53-6.5	6.61	16.61	5	18.1-128
Lead-210	3.77	6	5.1-17	8.77	18.77	4	47.5-212
Uranium – 235 Decay Series							
Uranium-235/236	1.15	1	1.46	6.15	16.15	0	
Proactinium-231	NE	5	11.1	5.0	15.0	3	26.9-73.2
Actinium-227	NE	6	6.3	5.0	15.0	2	18.5-43.8
Radium-223	NE	5	6.67	5.0	15.0	3	16.1-44.3
Thorium – 232 Decay Series							
Thorium-232	1.55	5	1.64-10.3	6.55	16.55	0	
Radium-228	2.37	0		7.37	17.37	0	
Thorium-228	1.33	2	1.55	6.33	16.33	0	
Radium-224	NE	29	6.48	5.0	15.0	1	39.1
Lead-212	2.26	0		7.26	17.26	0	
Bismuth-212	NE	19	4.5	5.0	15.0	0	
Thallium-208	0.71	0		5.71	15.71	0	

Notes: All units in pCi/g.

NE = Not established, all background samples below minimum detectable activity.

Table 4-3 : Summary of Radiological Levels for Surface Materials in Area 2

Radiological Constituents	Background Value (mean + 2 std. dev.)	> Background but < Reference		Reference Levels		> Reference Level	
		# Detects	Range	Surface-subsurface		# Detects	Range
Uranium – 238 Decay Series							
Uranium-238	2.24	2	3.1-3.63	7.24	17.24	2	49.7-251
Thorium-234	2.76	0		7.76	17.76	2	182-263
Uranium-234	2.73	3	3.3-5.22	7.73	17.73	3	7.93-2,050
Thorium-230	2.45	1	6.15	7.45	17.45	8	20.8-1,320
Radium-226	1.30	3	1.54-4.78	6.30	16.30	5	6.73-1,097
Lead-214	1.13	13	1.28-5.26	6.13	16.13	3	8.8-294
Bismuth-214	1.61	3	1.76-4.2	6.61	16.61	1	7.3
Lead-210	3.77	2	3.99-4.05	8.77	18.77	4	9.58-575
Uranium – 235 Decay Series							
Uranium-235/236	1.15	5	1.21-5.35	6.15	16.15	9	17.6-75.5
Proactinium-231	NE	11	0.75-2.41	5.0	15.0	6	26.9-544
Actinium-227	NE	9	0.42-0.58	5.0	15.0	3	15-305
Radium-223	NE	6	0.16-0.39	5.0	15.0	3	58.3-469
Thorium – 232 Decay Series							
Thorium-232	1.55	0		6.55	16.55	5	6.73-4,330
Radium-228	2.37	0		7.37	17.37	0	
Thorium-228	1.33	1	4.97	6.33	16.33	0	
Radium-224	NE	3	3.09-3.4	5.0	15.0	2	127-6,580
Lead-212	2.26	0		7.26	17.26	0	
Bismuth-212	NE	0		5.0	15.0	0	
Thallium-208	0.71	0		5.71	15.71	0	

Notes: All units in pCi/g.

NE = Not established, all background samples below minimum detectable activity.

Table 4-4 : Summary of Radiological Levels for Subsurface Materials in Area 2

Radiological Constituents	Background Value (mean + 2 std. dev.)	> Background but < Reference		Reference Levels		> Reference Level	
		# Detects	Range	Surface-subsurface		# Detects	Range
Uranium – 238 Decay Series							
Uranium-238	2.24	5	2.8-15.5	7.24	17.24	5	43.8-138
Thorium-234	2.76	0		7.76	17.76	7	24.5-774
Uranium-234	2.73	3	2.9-6.02	7.73	17.73	9	39.3-1,930
Thorium-230	2.45	1	4.22	7.45	17.45	12	25.8-83,000
Radium-226	1.30	2	3.26-5.1	6.30	16.30	9	30.2-3,060
Lead-214	1.13	34	1.17-11.4	6.13	16.13	8	60.7-22,00
Bismuth-214	1.61	12	1.32-1.81	6.61	16.61	4	24.5-3,060
Lead-210	3.77	6	4.51-12.5	8.77	18.77	8	45.4-1,300
Uranium – 235 Decay Series							
Uranium-235/236	1.15	38	1.17-14.1	6.15	16.15	25	16.2-57,300
Proactinium-231	NE	70	.33-12.5	5.0	15.0	9	85.9-1,100
Actinium-227	NE	40	.43-12.6	5.0	15.0	8	93.2-3,150
Radium-223	NE	27	.07-9.83	5.0	15.0	9	22.4-5,270
Thorium – 232 Decay Series							
Thorium-232	1.55	4	1.76-3.84	6.55	16.55	5	106-180
Radium-228	2.37	3	14.5-16.7	7.37	17.37	0	
Thorium-228	1.33	3	1.5-4.59	6.33	16.33	0	
Radium-224	NE	22	2.21-12	5.0	15.0	0	
Lead-212	2.26	3	2.49-10.8	7.26	17.26	1	8.2
Bismuth-212	NE	5	.67-1.86	5.0	15.0	0	
Thallium-208	0.71	5	1.13-7.9	5.71	15.71	0	

Notes: All units in pCi/g.

NE = Not established, all background samples below minimum detectable activity

Table 4-5 : Ford Property Analytical Results

Sample ID	Sample Date	Sample Depth	Uranium-238	Uranium-234	Thorium-230	Radium-226	Lead-214	Bismuth-214	Lead-210	Uranium-235/236	Proactinium-231	Actinium-227	Radium-223
Surface Reference Standard			7.24	7.73	7.45	6.3	6.13	6.61	8.77	6.15	5	5	5
Subsurface Reference Standard			17.24	17.73	17.45	16.3	16.13	16.61	18.77	16.15	15	15	15
FP1 0-3	12-May-97	0.25	0.81	0.73	12.8	<7.23	<0.98	<1.25	<1460	0.15	<6.1	<2.81	<13.2
FP1 0-3	12-May-97	0.25	0.8	0.84	1.39	7.19	1.68	<1.00	<4.47	0.15	<8.11	<2.12	<4.5
FP1 12-24	12-May-97	2.00	0.75	0.69	1.16	<4.94	0.73	<1.14	<3.83	0.13	<6.26	<1.38	<2.98
FP2 0-3	12-May-97	0.25	1.17	1.08	2.92	<6.28	0.75	<1.27	4.96	0.14	<8.77	<1.69	<4.05
FP2 12-24	12-May-97	2.00	0.94	0.78	1.24	7.99	<1.22	<1.29	<3.66	0.26	<8.86	<1.96	<4.76
FP3 0-3	12-May-97	0.25	0.79	0.69	1.26	<6.23	<0.89	<1.11	<4.30	0.063	<8.34	<2.23	<4.81
FP3 12-24	12-May-97	2.00	2.62	1.94	1.26	<4.24	1.03	<1.01	<3.19	0.38	<4.24	<0.95	<2.42
FP4 0-3	12-May-97	0.25	0.96	1.01	2.61	9.06	1.00	<1.20	4.35	0.11	<6.8	<1.48	<3.88
FP4 12-24	12-May-97	2.00	0.84	0.71	2.20	<5.58	1.13	<1.28	3.97	0.095	<8.97	<2.21	<4.84
FP5 0-3	12-May-97	0.25	1.05	0.84	28.6	4.08	1.54	<0.65	<811	0.062	<5.21	<1.39	<7.38
FP5 12-24	12-May-97	2.00	1.20	1.11	5.31	<6.04	1.07	<1.05	4.62	0.22	<7.37	<1.95	<4.66
FP6 0-3	12-May-97	0.25	0.91	0.73	1.20	<5.59	0.82	<1.25	<2.78	0.07	<6.66	<1.52	<3.42
FP6 12-24	12-May-97	2.00	1.07	0.86	1.80	<3.25	<0.92	<0.96	<3.73	0.093	<5.87	<1.36	<3.25
FP7 0-3	12-May-97	0.25	0.82	0.88	2.08	4.72	0.85	<0.89	<3.22	0.15	<7.08	<1.42	<3.22
FP7 12-24	12-May-97	2.00	0.71	0.65	1.51	<6.63	1.12	<0.95	<3.98	0.05	<6.77	<1.71	<3.98
FP8 0-3	12-May-97	0.25	0.81	0.95	21.8	<5.22	1.49	<1.15	4.96	0.11	<6.96	<1.33	<3.96
FP8 1-2	12-May-97	2.00	1.15	1.28	3.25	12.20	1.50	<1.83	<4.9	0.18	<7.65	<2.04	<4.92

Note: All units in pCi/l, except depth (feet)

< indicates sample result is below specific MDA

Table 4-5 : Ford Property Analytical Results (continued)

Sample ID	Sample Date	Sample Depth	Thorium-232	Radium-228	Thorium-228	Lead-212	Bismuth-212	Thallium-208
Surface Reference Standard			6.55	7.37	6.33	7.26	5	5.71
Subsurface Reference Standard			16.55	17.37	16.33	17.26	15	15.71
FP1 0-3	12-May-97	0.25	1.10	<2.13	1.15	<0.97	<5.69	<0.51
FP1 0-3	12-May-97	0.25	1.06	<2.06	1.22	0.92	<5.36	<0.53
FP1 12-24	12-May-97	2.00	0.84	<2.29	0.93	0.80	<5.82	<0.5
FP2 0-3	12-May-97	0.25	1.08	<2.85	1.20	1.24	<6.71	<0.62
FP2 12-24	12-May-97	2.00	1.13	<2.61	1.17	1.41	<6.62	<0.59
FP3 0-3	12-May-97	0.25	0.85	<2.05	0.90	1.13	<4.13	<0.51
FP3 12-24	12-May-97	2.00	0.91	<1.66	0.78	0.88	<4.24	0.44
FP4 0-3	12-May-97	0.25	1.16	<2.60	1.53	1.15	<4.36	<0.61
FP4 12-24	12-May-97	2.00	1.28	<1.73	1.42	1.23	<7.11	<0.58
FP5 0-3	12-May-97	0.25	1.38	<0.94	1.46	1.14	<2.96	0.46
FP5 12-24	12-May-97	2.00	1.20	<1.96	1.25	0.93	<6.68	<0.48
FP6 0-3	12-May-97	0.25	0.95	<1.56	0.97	1.26	<6.74	<0.48
FP6 12-24	12-May-97	2.00	1.2	<1.95	0.91	<0.76	<6.09	<0.49
FP7 0-3	12-May-97	0.25	1.14	<1.78	1.08	1.59	<5.54	<0.39
FP7 12-24	12-May-97	2.00	0.10	<2.13	1.18	<0.72	<6.19	<0.52
FP8 0-3	12-May-97	0.25	1.57	<1.68	1.37	0.98	<5.67	<0.57
FP8 1-2	12-May-97	2.00	1.73	<3.06	1.78	1.51	<8.59	0.59

Note: All units in pCi/l except depth (feet)

< indicates sample result is below specific MDA

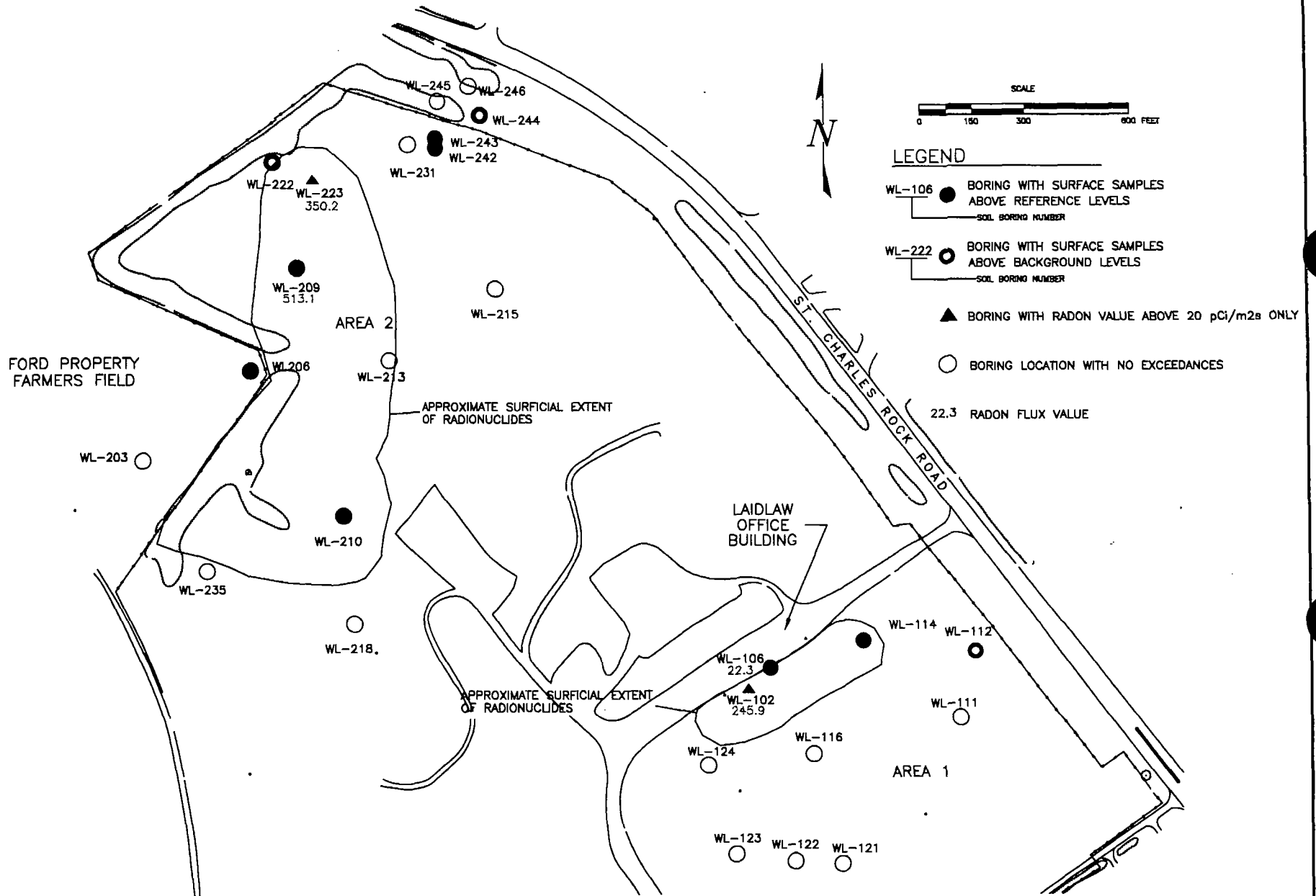


Figure 4-1 : Summary of Radiological Results for Surface Samples in Area 1

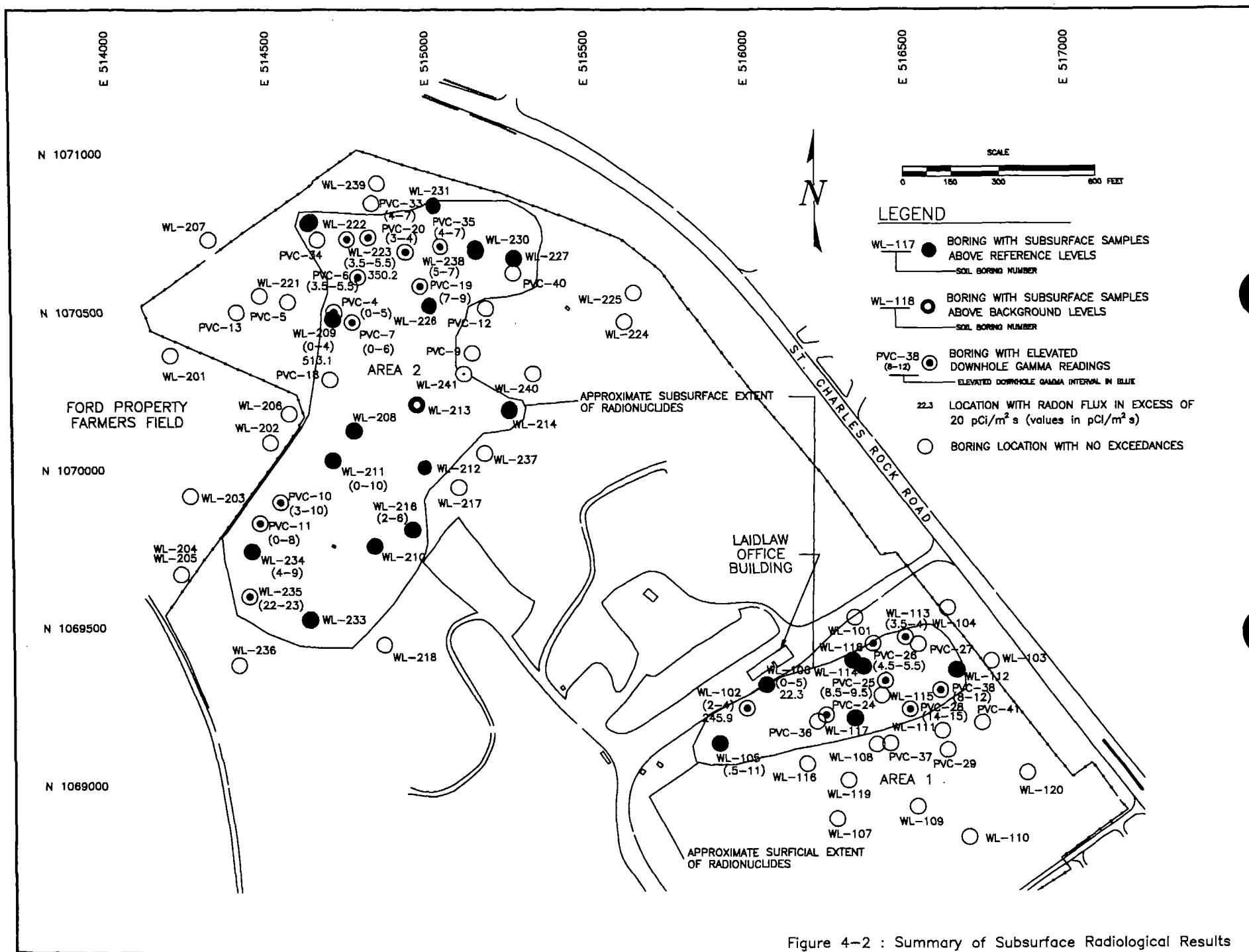


Figure 4-2 : Summary of Subsurface Radiological Results

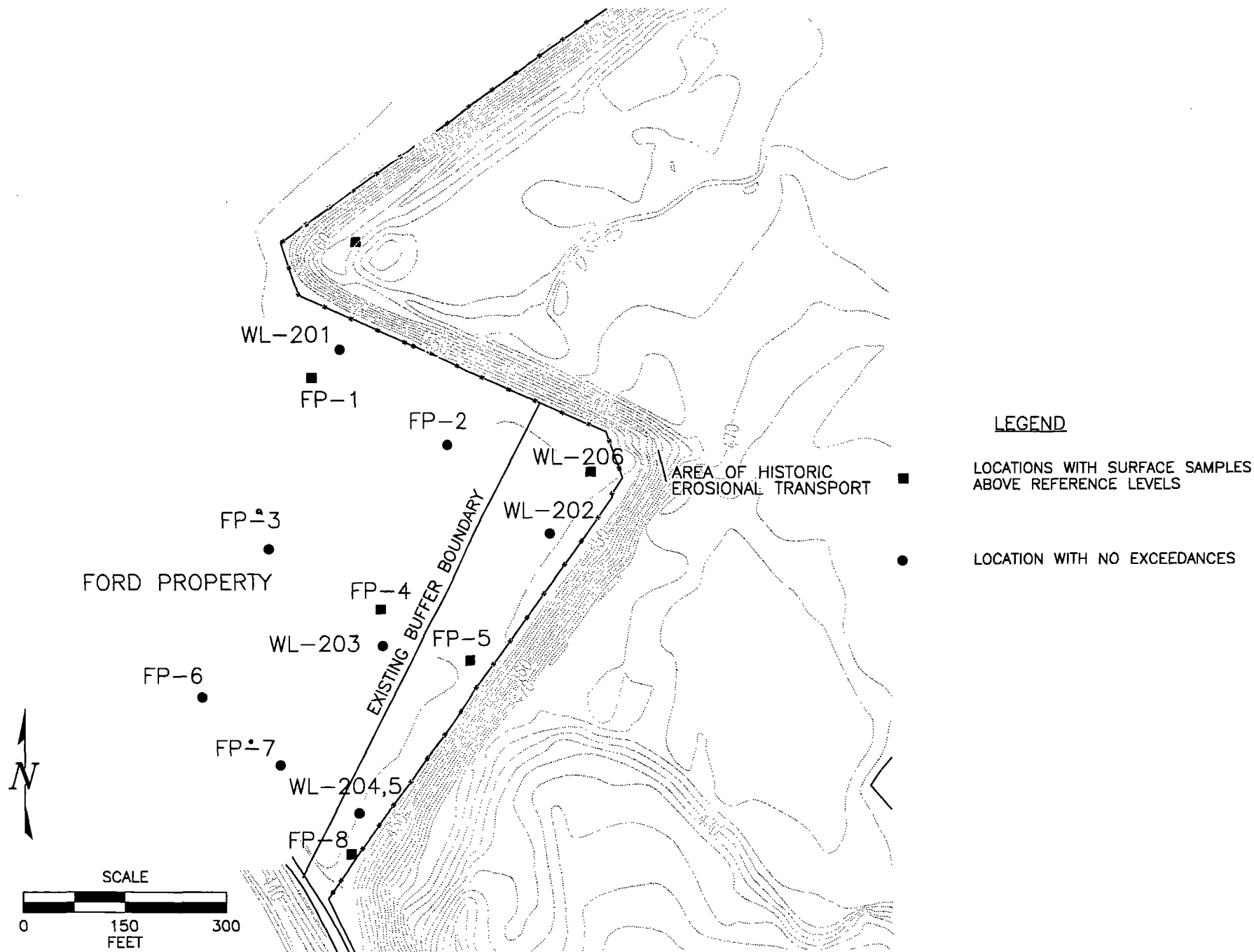


FIGURE 4-3 : SUMMARY OF RESULTS FOR THE FORD PROPERTY

5. IDENTIFICATION OF POTENTIAL EXPOSURE PATHWAYS AND EXTENT OF MIGRATION

This section identifies the potential exposure pathways at the Site and discusses the extent of affected material migration for each pathway. The potential pathways include:

- Airborne transport of radon gas and radionuclides in fugitive dust;
- Direct exposure to source materials;
- Rainwater runoff transport of radionuclides in the on-site and offsite water;
- Transport of radionuclides in the on-site and offsite erosional sediments;
- Sediment transport from the berm on the northwestern boundary of Area 2 onto the Ford property;
- Direct exposure to seeps;
- Migration of perched water or leachate seeps offsite; and
- Leaching of radionuclides downward to the underlying groundwater and potential for offsite migration.

Data from both the McLaren/Hart and the EMSI field programs are summarized as necessary. A complete listing of all the analytical results from both programs and sample location figures are included in Appendix A. The original laboratory reports for the McLaren/Hart data are included in the appropriate reports. The original laboratory documents for the EMSI effort will be submitted under separate cover.

5.1 Airborne transport

Radionuclides can be transported to the atmosphere either as a gas in the case of the various radon isotopes or as fugitive dust in the case of the other radionuclides. Both potential pathways are evaluated below based on Site-specific data.

5.1.1 Radon Gas

Radon gas is discharged as a result of the decay of radium. The radon gas could potentially follow two pathways:

- Radon could be discharged directly to the surface where it could be inhaled on-site or be transported by wind offsite; and
- Radon could be discharged in the subsurface and travel laterally along with other landfill gases until it is able to escape to the surface.

Both potential pathways and the extent of migration are evaluated below.

5.1.1.1 Surface Emission of Radon Gas

The radon flux measurement program completed by EMSI in June 1997 employed the Large Areas Activated Charcoal Canisters (LAACC) method presented in Method 115, Appendix B, 40 CFR, Part 61. This method was established to measure radon flux values on uranium mill tailing piles. Radon flux was measured rather than concentration because no structures are present in either Area 1 or Area 2 that would result in the build-up of radon concentrations. Instead, the potential transport pathway is the migration of the gas through the atmosphere.

The radon flux measurements were made at locations adjacent to each of the random boring locations within the grids established for the soil sampling programs within Area 1 (one sample in each of 22 grids) and Area 2 (one sample in each of 32 grids). These locations were randomly selected by McLaren/Hart and are thus statistically unbiased. Each sample in Area 1 is representative of the 38,250 square foot area within individual 170 foot by 225 foot grids. Each sample in Area 2 is representative of the 67,600 square foot area within individual 260 foot by 260 foot grids. The resulting data are summarized in Table 5-1.

No standards for radon emissions that are directly applicable to the Site have been established. In 40 CFR Part 61, EPA established a standard of an average of 20 pCi/m²s for radon emissions for uranium mill tailings from a number of samples (generally 100) collected from the surface of the tailings in a statistically unbiased fashion. Although this standard is only directly applicable to uranium mill tailings, it represents a health-based standard derived by EPA that can be used for comparative purposes until a Site-specific standard is established in the BRA.

The average radon flux value for Area 1 is 13 pCi/m²s (Table 5-1). This average is below the standard for uranium mill tailings. Moreover, only the two discrete radon flux

measurements from locations WL-102 (246 pCi/m²s) and WL-106 (22.3 pCi/m²s) in Area 1 were above the 20 pCi/m²s uranium mill tailing standard, and these two locations generate the majority of the radon in Area 1. WL-102 had down-hole gamma readings with maximum peaks at or above 6,000 counts per minute but the soil samples did not contain radionuclides above reference levels. WL-106 had both down-hole gamma readings with maximum peaks at or above 6,000 counts per minute and surface and subsurface soil samples containing radionuclides above reference levels. If the emissions from these two locations are not included in the calculation of the average value, the flux across Area 1 would decline to 0.87 pCi/m²s: 23 times less than the standard.

The average radon flux for Area 2 is 28 pCi/m²s. This average is above the EPA uranium mill tailings pile standard; however only two locations, WL-209 (513.1 pCi/m²s) and WL-223 (350 pCi/m²s) are above the uranium mill tailing standard and generate the majority of the radon in Area 2. WL-209 had both down-hole gamma readings with maximum peaks at or above 6,000 counts per minute and surface and subsurface soil samples containing radionuclides above reference levels. WL-223 had down-hole gamma readings with maximum peaks at or above 6,000 counts per minute but the soil samples did not contain radionuclides above reference levels. If the emissions from these two locations are not included in the calculation of the average value, the average value for Area 2 declines by a factor of over 29 to 0.94 pCi/m²s.

The radon flux was measured directly at the ground surface within the confined space of each LAACC. The actual radon emissions will be immediately dispersed by the atmospheric movements as the gas migrates from the ground surface to the breathing zone, resulting in far less exposure to the potential receptors. The effect of dispersion must be considered during the baseline risk assessment for on-site workers. In assessing offsite risk, the BRA must also consider the effect of the additional dispersion that would occur as the gas migrates toward the Site boundaries.

5.1.1.2 Radon Migration With Landfill Gas

Radon gas from Areas 1 and 2 could also conceivably migrate laterally along with other landfill gases until it emerges at the surface or is captured by the collector system on the south side of Area 1. The average radon flux for all 54 measurements across Area 1 and Area 2 is 22 pCi/m²s. In a worst-possible situation, the generated radon gas would migrate toward the collector system; however, radon concentrations would decline as decay occurs. The final concentration at the landfill boundary would thus be substantially lower given the 3.8 day half life for radon-222, the primary radon radionuclide of concern. In addition, landfill gases generated from the remaining areas of the landfill would further dilute the radon concentrations within the landfill gases as they migrated from their original locations toward the boundaries to well below the standard.

Exposures from radon gas exhausted from the existing landfill flare were evaluated by Golder Associates (Golder Associates, 1995c). Golder collected samples from the flare and evaluated the resulting radon-222 measurements relative to probable risk. Golder concluded in Section 6 of that report that "recent measurements of radon daughter products, to which on-site workers may be potentially exposed via inhalation, are nearly 10 times below the recommended EPA regulatory limit..."

Based upon the discussions in the preceding two paragraphs, EMSI does not consider radon migration in landfill gas to be a viable migration pathway.

5.1.2 Fugitive Dust

McLaren/Hart conducted fugitive dust sampling on an extremely windy day (wind speed 14 mph or greater) following a prolonged period with no precipitation to evaluate conditions under a worst-case scenario (McLaren/Hart 1996d). Trace levels of both uranium-238 and thorium-232 decay series radionuclides were detected in both the upwind and downwind samples collected from both Area 1 and Area 2. Also, there were no significant differences between the levels in the upwind and downwind samples.

Review of the uranium-238 decay series results for Area 1 indicates that the thorium-230 and radium-226 results are similar or lower at the downwind location compared to the upwind results. Review of the uranium-235 decay series results indicates that none of the samples exceeded the minimum detectable activity (MDA) values. Review of the thorium-232 decay series results indicates that their activity levels appear to decrease across the Area 1 fugitive dust sampling Site but increase across the Area 2 location. The data from the three decay series indicates that no wind-related effects are present. Review of the MDAs and sigma errors indicate that the differences in the radiological results are very minor.

The fugitive dust data were compared to published occupational exposure limit criteria for "stack emissions" (10 CFR Part 20, Appendix B, Tables 1 and 2). The most stringent exposure limit levels are for uranium-238 and thorium-230. The detected uranium-238 and thorium-230 levels were below these standards. It should also be noted that the fugitive dust samples were collected within 40 feet of defined radiologically affected areas in each area rather than on the perimeter of the entire Site. Based upon these facts, EMSI concludes that atmospheric transport of particulates is not a viable exposure pathway.

5.2 Direct Exposure To Source Materials

Both Area 1 and Area 2 are in inactive parts of the Site that are rarely visited by Site workers. Moreover, dosimeters worn by McLaren/Hart workers during performance

of the primary field program indicated that little or no on-site exposure was occurring. However, direct exposure to radionuclides in the parts of Area 1 and Area 2 where no cover is present must be regarded as a potential exposure pathway and should be evaluated as part of the baseline risk assessment.

5.3 Rainwater Runoff Transport

Section 10 CSR 60-4.060 of the Missouri Code of State Regulations contains published drinking water standards for radium-226, radium-228 and gross alpha particle radioactivity as follows:

For radium-226, radium-228 and gross alpha particle radioactivity, the maximum contaminant level (MCL) shall be:

Combining radium-226 and radium-228, five picocuries (5pCi) per liter. A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis, but only if the measured gross alpha particle activity does not exceed five (5) pCi/l.

Measuring gross alpha particle activity, including radium-226 but excluding radon and uranium, fifteen (15) pCi/l. When the gross alpha particle activity exceeds five (5) pCi/l, the same or an equivalent sample must be analyzed for radium-226. If the concentration of radium-226 exceeds three (3) pCi/l the same or an equivalent sample shall be analyzed for radium-228.

5.3.1 Weir Runoff Samples

The individual results for rainwater runoff samples collected by McLaren/Hart are presented in Table 5-2. Precipitation events since approval of the Amended Sampling and Analysis Plan (ASAP) (EMSI, 1997a) have not been sufficiently intense to permit Site-wide resampling.

None of the McLaren/Hart samples were analyzed for gross alpha radioactivity. Based upon the available information, EMSI concluded that the radium-226 results in the sample from Weir 9 exceeded the Missouri MCL; however, it should be noted that runoff from Weir 9 immediately mixes with unaffected runoff from other regions not within Area 1 or Area 2. To assess this mixing process, EMSI has added an additional weir (Weir 10) in the lower part of the roll-off area as shown in Figure 5-1.

EMSI also concluded in the IIR Technical Memorandum (EMSI 1996a) that the remaining rainwater runoff samples had radium-226 levels below the MCL. The radium-228 values could not be assessed because the analytical method used resulted in MDA values that exceeded the MCL. As discussed below, the water samples collected as part

of the recent surface water-sampling episode had radium-226 and radium-228 activities that were nearly equivalent, indicating a 1 to 1 activity ratio. Based upon the McLaren/Hart radium-226 values and the indicated 1 to 1 activity ratio between radium-226 and radium-228, Weir 5 is the only other location that may yield water that exceeds the MCL. The discharge from Weir 5 is toward the northwest adjacent to the Ford property. This location is approximately 700 feet from the drainage control channel; the nearest channelized surface water. The area between the slope at the base of the weir and the surface channel is flat, and no indication of measurable overland flow is present. The extent of radionuclide migration on to the Ford property has also been sufficiently delineated to conclude that runoff from Weir 5 has not reached any definable surface water bodies. Based upon the above information, EMSI concludes that no releases from Weir-5 to the drainage control channel have occurred.

In addition to radium-226, rainwater runoff samples from Area 1 were analyzed by McLaren/Hart for thorium-228, -230, and -232 as well as uranium 235/236 and uranium 238. With the exception of uranium-238, the concentrations were well below 1 pCi/l. The concentrations of uranium-238 varied from 0.36 pCi/l to 3.66 pCi/l.

The rainwater runoff samples from Area 2 were analyzed by McLaren/Hart for all the radionuclides in the three decay series; however the detection limits for thorium-234, lead-214, bismuth-214, lead-210, uranium-235, protactinium-231, actinium-227, radium-223, radium-228, radium-224, lead-212, and thallium-208 all exceed 10 pCi/l. The importance, if any, of these high MDAs will be evaluated as necessary in the BRA. The radionuclides measured in the weir 5 rainwater runoff sample had concentrations that generally ranged from 1 to 6 pCi/l except for uranium-234 and uranium-238. These compounds generally had concentrations between 40 and 49 pCi/l. The other sampling locations had radionuclide concentrations that were similar to those measured in the Area 1 rainwater runoff samples.

Based upon the sampling completed to date, it appears that only the water draining to Weir-5 produces measurable offsite impacts. It should also be noted that the offsite impacts from the water measured at Weir-5 do not affect any surface-water; therefore rainwater runoff does not appear to be a viable exposure pathway.

Samples will be collected from each weir with ponded or flowing water during the next major precipitation event. The results of that sampling will be forwarded to EPA and incorporated into the risk assessment process, including revision of exposure pathway conclusions, as applicable.

5.3.2 Surface Water Samples

McLaren/Hart and EMSI collected two sets of samples from each of the two surface water bodies that could potentially receive runoff from Area 1 and Area 2.

Sampling locations are shown on Figure 5-1. The two points were established at the first offsite locations of permanent surface water that would likely receive Site runoff. Sampling point SW-1 was established by McLaren/Hart in the Earth City Flood Control Channel at the intersection of the northwestern Site boundary with Old St. Charles Rock Road. Sampling point SW-2 was established by McLaren/Hart immediately north of the Site boundary in a ponded area within the drainage ditch on the south side of St. Charles Rock Road.

The results are included in Table 5-3. The McLaren/Hart values could not be directly evaluated relative to the MCL because of the high MDA (>200 pCi/l) for the radium-228 results. The samples collected by EMSI in May 1997 did not exceed the State MCLs for radionuclides because the sum of the radium-226 and radium-228 values did not exceed 5 pCi/l.

The radium-226 activities from the McLaren/Hart samples were generally less than the activities from the EMSI samples. The activities for radium-226 and radium-228 were nearly equal for each sample collected by EMSI. Assuming the radium-228 activities for the McLaren/Hart values also nearly equaled the radium-226 values, then these samples also did not exceed the MCLs.

Based upon the locations of the sampling points and the lack of radionuclide concentrations above MCLs, EMSI concludes that surface water does not act as an migration pathway.

5.4 Sediment Transport

Transport of erosional sediment on-site and offsite may be a potential exposure pathway. Potential sediment transport pathways include surface drainages and erosion of sediment from the northern Area 2 slope.

5.4.1 Sediment Transport in Surface Drainages

Analytical results for sediment samples collected in two different rounds of sampling are summarized in Table 5-4. The surface soil reference levels are included on Table 5-4 since no specific standards exist for sediment materials. As discussed in detail at the beginning of Section 4, these standards are only applicable to uranium and thorium mill tailings sites and standards appropriate for use at this Site will be developed as part of the BRA. These results indicate that radiological constituents are present in sediments above their reference levels at weir locations #1 and 2 in Area 1 and at weir locations #5, 6, 7 and 9 in Area 2. The exit points for sediment from the Site differ for Area 1 and Area 2 so they will be discussed separately.

5.4.1.1 Area 1 Surface Drainages

The samples from Weir 1 and Weir 2 in Area 1 both represent sediments that will migrate into the drainage ditch south of the main Site access road. The sediments in this ditch are potentially transported to the northeast where they could exit the Site to the perimeter drainage ditch on the southwest side of St. Charles Rock Road. Water in the St. Charles Rock Road perimeter drainage ditch then flows northwest until it encounters the surface water body north of the Site.

EMSI collected sediment samples from four additional locations in May 1997 to further evaluate potential sediment transport through the perimeter drainage ditch along St. Charles Rock Road. Sample locations are shown on Figure 5-1. Sample Sed 1 and its duplicate, located at the intersection of the property boundary and the drainage ditch south of the main Site access road, both contained radionuclides at or slightly exceeding the surface reference levels; however, the constituent exceeding the reference level varied in the two samples. The primary sample contained radium-226 at an activity level slightly higher than the reference level (6.7 pCi/g versus 6.3 pCi/g); however radium-226 was not detected in the duplicate sample (the detectable activity level was 5.06 pCi/g). Similarly, the duplicate for sample Sed 1 contained uranium-234 at an activity level of 16.3 pCi/g versus a reference level of 7.73 pCi/g; however, the original Sed 1 sample had a measured level of uranium-234 of only 0.95 pCi/g. The results indicate that heterogeneity cannot be completely eliminated in the samples despite thorough mixing; however, if the values from both samples are averaged (including the full MDA value for radium-226) the resulting means fall below the surface standard. No other radionuclides were measured above the surface reference level.

Samples were also collected in the drainage ditch north of the Site access road (SED-2, Figure 5-1) and at two locations in the perimeter drainage ditch situated along the of St. Charles Rock Road (SED-3 and SED-4, Figure 5-1). No radionuclides, including radium-226 and uranium-234, were measured above the reference level.

One or more of the constituents in each offsite sediment sample had minimum detectable activity values that slightly exceeded the reference level. SED-3 and the duplicate to SED-1 had excessively high minimum detectable activity values for lead-210. The differences in values between the original and duplicate Sed 1 samples and the elevated minimum detectable activities for lead-210 are currently being reevaluated as part of the data validation process.

Off-site sediment transport will be considered for sediments in the drainage ditch south of the Site access road; however, the sediment sample results indicate that this route will not translate into a viable exposure pathway.

5.4.1.2 Area 2 Surface Drainages

The sediment samples obtained from weirs #5, #6 and #7 were all obtained from the top of the landfill slope along the northwest portion of Area 2 above the Ford property. All three of these locations drain down onto the Ford property into the unused portion of the area referred to as the buffer. As discussed above in the surface water section, this area is extremely flat and the extent of surficial soil impacts has been defined. As a result, no further offsite transport of radionuclides is expected in this area.

Weir #9 was located to obtain samples to assess runoff and sediment transport from Area 2 to other parts of the Site. Sediment samples obtained from weir #9 contained radionuclide activities greater than reference levels. Drainage from weir #9 flows down the access road into the drainage along the north side of the Site access road and out into the perimeter drainage ditch along the southwestern side of St. Charles Rock Road. Sample SED-2, collected from this ditch, contained no radionuclides above reference levels; therefore, sediment migration from the weir #9 drainage area is not a viable offsite transport mechanism.

5.4.2 Sediment Transport From Area 2 Slope Erosion

The soil samples collected by McLaren/Hart from the northwestern part of Area 2 and the soil samples collected by EMSI during implementation of the ASAP indicate that transport of radiologically impacted soils from Area 2 onto the buffer area of the Ford property has historically occurred. Furthermore, review of the results of the analyses of the erosional weir sediment samples obtained from this area (weir sample locations #5, 6 and 7) indicates that some limited transport of soil/sediment potentially may be continuing to occur from the berm along the western portion of Area 2. Specifically, at sample location #5, the sediments contained levels of several uranium-238 decay series constituents above both background and reference levels. Other than actinium-227, constituents of the uranium-235 and thorium-232 decay series were either not detected or not detected above background levels in the sample from this location. The thorium-230 levels in the samples from locations #6 and 7 also exceed the reference level. Radium-226 and lead-214 were detected at levels above the reference level in the sample from location #6.

Results from samples collected from the Ford property during implementation of the ASAP that were discussed in Section 4.2.3 indicate that offsite transport is limited to individual radionuclides in the upper 6-inches of soils at two of eight sampling locations. Based on the presence of diversion berms at the top of the landfill slope, the surface and vegetative conditions along the slope, evaluation of sediment erosion and deposition mechanisms, and the lack of discernable erosion on the slope following significant precipitation events in 1993 and 1995, the potential for significant erosional failure of the landfill slope prior to implementation of the remedy appears to be minimal.

5.5 Migration in Perched Groundwater Or The Leachate Seep

A compilation of all of the perched groundwater and leachate results is in Appendix A. Figure 3-11 presents the distribution of perched water identified within the landfill in the vicinity of Areas 1 and 2. As can be seen from this figure and as indicated by McLaren/Hart in the Soil Boring/Surface Soil Investigation Report (McLaren/Hart, 1996h), the distribution of perched water is of limited extent and the various perched waters are isolated in nature. Surface seepage of perched water appears to only occur in the southwestern corner of Area 2 at the location of the leachate seep identified by McLaren/Hart.

Four perched water samples were collected by McLaren/Hart and analyzed for radionuclides including one from Area 1 and three from Area 2. In addition, one sample was obtained from the leachate seep.

Uranium-238 decay series constituents were present in the perched water and the Area 2 seep. Uranium-238, thorium-234, uranium-234 and thorium-230 were detected in the perched water samples. All of the compounds were present at levels less than 1 pCi/l except for thorium-230 in the WL-220 (1.72 pCi/l) and WL-231 (3.70 pCi/l) samples. Uranium-238, uranium-234, thorium-230 and radium-226 were all present at levels less than 1 pCi/l in the Area 2 seep samples. No uranium-235 decay series constituents were detected in the perched water samples. Thorium-232 decay series constituents were detected in only one of the perched water samples: the sample obtained from boring WL-219 in Area 2. This sample contained low levels of thorium-232 (0.042 pCi/l) and thorium-228 (0.12 pCi/l).

The levels of the uranium-238 decay series constituents detected in the leachate seep samples were similar to those found in the background groundwater monitoring wells. In addition, radium-226 was detected at 0.83 pCi/l in this sample, well below the MCL 1 pCi/l for radium-226 and radium-228 combined. The very low radium-226 activities measured in the leachate seep samples coupled with the nearly equal radium-226 and radium-228 activity values measured in the EMSI surface water samples strongly suggests that the leachate water is below the Missouri State MCLs.

Based on the limited and isolated nature of the perched water and leachate seep, combined with the overall low levels of radionuclides detected in the samples of these waters, the perched water and/or leachate seep do not represent a significant source or pathway for migration of radionuclides from the Site.

5.5.1 Leaching to Groundwater and Subsequent Off-site Transport

A compilation of all of the groundwater results is presented in Appendix A. A summary of the May 1997 groundwater monitoring results and historic values for background wells are included in Table 5-5. Constituents in the uranium-238, uranium-

235 and thorium-232 decay series were detected in both of the up gradient background wells (S-80 and MW-107). Constituents in the uranium-238, uranium-235 and thorium-232 decay series were measured near background levels in the non-background Site wells. Constituent levels were generally below 3 pCi/l in the Site wells. Uranium-234, thorium-230, and thorium-228 were the only radionuclides with five or more occurrences of measured concentrations above 3 pCi/l. In addition, there were minimal differences between the results obtained from the filtered and unfiltered samples.

As discussed earlier, the Missouri MCLs apply to combined analysis of radium-226 plus radium-228 and/or gross alpha radioactivity. The groundwater samples collected in May 1997 were the only ones analyzed for gross alpha, radium-226 and radium-228. The analytical results indicate that only the sample from Well D-6 exceeded the State MCLs. The value measured at D-6 was very close to the MCL levels (a combined radium-226 and radium-228 value of 5.98 pCi/l versus the MCL value of 5.0 pCi/l. The value of 1.80 pCi/l for radium-226 is less than the 3.38 pCi/l reported in McLaren/Hart (1996g).

Table 5-6 presents all historic radium-226 results for the wells sampled in May 1977. The data indicates that the radium-226 concentrations from the previous sampling events are similar to the May 1997 results. The radium-228 results should also be similar; therefore, the groundwater from the previous sampling events was also probably below MCLs with the exception of D-6.

Well D-6 is on the northwestern boundary of Area 2 (Figure 5-1) so the fate and transport of the radionuclides in this area will have to be assessed. Given that: 1) the exceedance closely approaches the MCL; 2) well D-6 is just offsite from the property but within the buffer area; 3) the distance from well D-6 to any existing water wells (approximately 5,100 feet in this direction); 4) the availability of municipal water; and 5) the lack of radionuclides above MCLs in other Site wells, EMSI does not believe that groundwater transport represents a significant pathway for radionuclides at the Site.

5.6 Direct Exposure To Seeps

As discussed in Section 5.5, the radiological compounds measured in the water discharging from the only active seep identified at the Site appear to be below the Missouri State MCLs. Because of this information, EMSI concludes that direct exposure to the seep is not a potential exposure pathway.

Table 5-1 : Radon Flux Results

Area 1		Area 2	
Boring Location	Radon Flux (pCi/m ² s)	Boring Location	Radon Flux (pCi/m ² s)
WL-101	0.3	WL-201	0.5
WL-102	245.9	WL-202	0.3
WL-103	0.6	WL-203	0.4
WL-104	0.2	WL-204/205	0.3
WL-105	0.2	WL-206	0.9
WL-106	22.3	WL-207	0.5
WL-107	0.2	WL-208	3.2
WL-108	0.5	WL-209	513.1
WL-109	0.1	WL-210	14.2
WL-110	0.2	WL-211	0.1
WL-111	0.3	WL-212	0
WL-112	1.9	WL-213	0.1
WL-113	0.5	WL-214	0.2
WL-114	8	WL-215	0.3
WL-115	1.4	WL-216	0.1
WL-116	0.2	WL-217	0.2
WL-117	1.3	WL-218	1.6
WL-120	0.3	WL-219	0.3
WL-121	0.3	WL-220	0.1
WL-122	0.5	WL-221	0.8
WL-123	0.1	WL-222	1.3
WL-124	0.2	WL-223	350.2
		WL-224	0.2
		WL-225	0.3
		WL-226	0.2
		WL-227	0.5
		WL-230	0.2
		WL-231	0.2
		WL-233	0.1
		WL-234	0.6
		WL-236	0.1
		WL-239	0.4
Average	13		28

Table 5-2 : Rainwater Runoff Results

Location	Radium-226	Radium-228	Thorium-232	Thorium-230	Thorium-228	Uranium-235/236
Weir 1	< 0.58	-	<0.236	0.026	< 0.545	<0.216
Weir 2	0.52	-	< 0.132	0.85	< 0.222	0.44
Weir 3	0.77	-	< 0.081	0.17	< 0.18	<0.19
Weir 4	< 0.50	-	< 0.096	0.28	< 0.190	<0.095
Weir 5	2.60	< 42.01	1.11	13.1	1.16	4.27
Weir 7	0.68	< 52.35	<0.35	1.88	0.66	0.69
Weir 8	< 0.28	< 59.13	1.87	5.27	2.55	<6.18
Weir 9	8.85	< 55.87	4.25	209	1.46	1.18
Leachate Seep	<0.66	-	< 0.375	0.92	< 0.636	<0.257
Surface Water North of Area 2	< 0.14	< 63.42	0.09	2.93	< 0.060	<2.02
Surface Water South of Area 2	< 0.21	< 40.52	0.27	1.15	0.09	<0.21

Notes: All units in pCi/l

Results presented are for unfiltered samples.

- indicates not analyzed for

< indicates sample result is below specific MDA

Table 5-3 : Surface Water Sample Results.

Station	Type	Date	Uranium-238	Thorium-234	Uranium-234	Thorium-230	Radium-226	Lead-214	Bismuth-214	Lead-210
Uranium-238 Decay Series										
SW-2	Unfiltered	Nov-95	<1.46	<280.2	3.11	2.93	<0.14	<33.18	<37.46	<2730
SW-2	Filtered	Nov-95	0.32	154	0.44	11.9	0.11	<21.38	<25.37	<306
SW-1	Unfiltered	Nov-95	0.79	<224	0.95	1.15	<0.21	<24.4	<24.01	<1320
SW-1	Filtered	Nov-95	1.07	<156	1.22	1.26	<0.08	<24.89	<26.47	<144
SW-1	Unfiltered	May-97	0.91	1.28	-	0.22	0.36	-	-	-
SW-2	Unfiltered	May-97	0.81	1.08	-	0.22	0.24	-	-	-
SW-1	Filtered	May-97	1.28	1.44	-	0.16	0.70	-	-	-
SW-2	Filtered	May-97	0.63	1.32	-	0.25	0.23	-	-	-
SW-2	Filtered	May-97	1.06	1.39	-	0.51	0.36	-	-	-
SW-1 (DUP)	Unfiltered	May-97	0.99	1.29	-	0.36	0.67	-	-	-

Uranium-235 Decay Series							
Station	Type	Date	Uranium-235/236	Uranium-235	Protactinium-231	Actinium-227	Radium-223
SW-2	Unfiltered	Nov-95	<2.02	<98.01	<477	<95.1	<834.9
SW-2	Filtered	Nov-95	<0.31	<64.68	<288	<65	<515.5
SW-1	Unfiltered	Nov-95	<0.21	<64.42	<339	<69.4	<608
SW-1	Filtered	Nov-95	<0.22	<52.97	<362	<58.8	<523.5
SW-1	Unfiltered	May-97	0.07	-	-	-	-
SW-2	Unfiltered	May-97	0.12	-	-	-	-
SW-1	Filtered	May-97	0.25	-	-	-	-
SW-2	Filtered	May-97	0.14	-	-	-	-
SW-2	Filtered	May-97	0.06	-	-	-	-
SW-1 (DUP)	Unfiltered	May-97	0.13	-	-	-	-

Notes: All units are pCi/l
 - indicates not analyzed for
 < indicates sample result is below specific MDA

Table 5-3 : Surface Water Sample Results. (continued)

Station	Type	Date	Thorium-232	Radium-228	Thorium 228	Radium-224	Lead-212	Thallium-208
Thorium-232 Decay Series								
SW-2	Unfiltered	Nov-95	0.09	<63.42	<0.06	<285.3	<25.75	<15.68
SW-2	Filtered	Nov-95	1.14	<38.16	<0.16	<204.8	<18.73	<12.54
SW-1	Unfiltered	Nov-95	0.93	<40.52	0.16	<212	<19.97	<12.51
SW-1	Filtered	Nov-95	0.14	<51.02	<0.17	<203.4	<MDA	<14.35
SW-1	Unfiltered	May-97	0.11	0.61	0.085	-	-	-
SW-2	Unfiltered	May-97	0.029	0.73	0.041	-	-	-
SW-1	Filtered	May-97	0.006	0.63	0.025	-	-	-
SW-2	Filtered	May-97	0.033	0.07	0.028	-	-	-
SW-2	Filtered	May-97	<0.008	0.64	0.048	-	-	-
SW-1 (DUP)	Unfiltered	May-97	0.056	0.34	0.058	-	-	-

Notes: All units are pCi/l
 - indicates not analyzed for
 < indicates sample result is below specific MDA

Table 5-4 : Sediment Sample Results

Station	Date	Uranium-238	Uranium-234	Thorium-230	Radium-226	Lead-214	Bismuth-214	Lead-210
Site Specific Background)		1.81	2.73	2.54	1.3	1.13	1.61	3.77
Reference Level Concentration		6.81	7.73	7.54	6.3	6.13	6.61	8.77
WEIR 1S	May-95	0.88	1.25	4.00	0.64	0.63	0.67	<1.72
WEIR 1S DUP (F)	May-95	--	--	--	<0.74	<0.65	<0.74	<42.6
WEIR 2S	May-95	2.79	2.56	147	18.8	19.5	18.8	33.1
WEIR 2S	May-97	2.15	1.77	215	<7.43	5.84	<1.88	10.6
WEIR 2S DUP (F)	May-95	--	--	--	3.32	3.59	2.85	5.98
WEIR 3S	May-95	0.65	0.94	6.36	0.64	0.63	<0.53	1.83
WEIR 3S	May-97	1.14	1.23	11.6	5.59	1.1	<1.15	<2.56
WEIR 3S DUP (F)	May-95	--	--	--	0.71	0.61	<0.58	2.56
WEIR 4S	May-95	0.87	1.04	1.57	0.66	0.62	<0.58	<1.74
WEIR 4S	May-97	0.62	0.7	1.46	<5.43	0.73	<0.88	<3.85
WEIR 4S DUP (F)	May-95	--	--	--	0.67	0.69	<0.53	<26.9
WEIR 5S	Apr-96	11.4	6.9	413	22.7	11.4	<2.34	<103
WEIR 5S	May-97	5	5.92	770	<13.9	<2.89	9.6	<1,880
WEIR 6S	Apr-96	<3.22	<8.21	39.2	8.05	1.62	<0.71	2.83
WEIR 6S	May-97	2.65	2.81	68.8	9.17	2.66	<1.67	5.98
WEIR 7S	Apr-96	<0.1	<0.2	9.00	<3.08	0.57	<0.65	<2.34
WEIR 7S	May-97	1.43	1.44	154	6.57	2.09	<1.78	16.3
WEIR 8S	Apr-96	1.28	<1.28	3.34	<5.44	<0.72	<0.81	<71.9
WEIR 8S	May-97	0.79	0.82	3.51	<6.13	<1.05	<1.37	<4.21
WEIR 9S	Apr-96	<2.37	5.28	150	6.68	2.59	2.4	10.1
WEIR 9S	May-97	2.5	4.06	1160	<13.7	21.8	18.5	31.7
SED 1 DUP	May-97	3.14	16.3	2.71	<5.08	<1.06	<1.07	<2,000
SED 1	May-97	0.97	0.95	2.93	6.74	1.72	<1.46	4.84
SED 2	May-97	0.71	0.58	1.7	<3.9	<0.6	<0.72	<2.22
SED 3	May-97	0.78	0.81	3.06	<6.17	<1.12	<1.11	<1,980
SED 4	May-97	0.53	0.69	4.04	5.4	0.83	<1.08	<3.72

Notes: All units are pCi/g

-- indicates not analyzed for

(F) indicates field duplicate

< indicates sample result is below specific MDA

Table 5-4 : Sediment Samples Results (continued)

Station	Date	Uranium- 235/236	Protactinium -231	Actinium- 227	Radium- 223
Site Specific Background		1.15	--	--	--
Reference Level Concentration		5.15	5	5	5
WEIR 1S	May-95	0.12	<6.29	<1.4	<2.42
WEIR1S DUP (F)	May-95	--	<6.48	<1.26	<6.77
WEIR 2S	May-95	<0.83	49.9	30.1	25.3
WEIR 2S	May-97	0.19	<10.7	<3.02	3.65
WEIR 2S DUP (F)	May-95				
WEIR 3S	May-95	<0.33	<4.15	<0.83	<4.53
WEIR 3S	May-97	0.18	<5.49	<1.37	<3.7
WEIR 3S DUP (F)	May-95				
WEIR 4S	May-95	<0.239	<4.44	<0.85	<3.7
WEIR 4S	May-97	0.09	<7.99	<1.83	<3.45
WEIR 4S DUP (F)	May-95	--	<4.56	<1.03	<4.52
WEIR 5S	Apr-96	<3.5	<14.2	7.75	<14.29
WEIR 5S	May-97	0.65	<0.19	<4.51	<26.2
WEIR 6S	Apr-96	<6.16	<4.2	<0.84	<4.13
WEIR 6S	May-97	0.25	<9.41	<2.74	<6.51
WEIR 7S	Apr-96	<0.27	<5.63	<1.26	<5.23
WEIR 7S	May-97	0.17	<9.99	<2.36	<6.59
WEIR 8S	Apr-96	<1.73	<8.98	<1.9	<7.7
WEIR 8S	May-97	0.2	<6.65	<1.59	<2.98
WEIR 9S	Apr-96	<5.2	<4.15	<0.71	<4.79
WEIR 9S	May-97	0.28	<16.3	5.72	4.4
SED 1	May-97	1.29	<8.85	<2.23	<11
SED 1 DUP	May-97	0.14	<10.7	<2.18	<4.6
SED 2	May-97	0.068	<5.84	<1.16	<2.56
SED 3	May-97	0.14	<8.8	<2.69	<11.2
SED 4	May-97	0.07	<5.9	<1.27	<2.46

Notes: All units are pCi/g
 -- indicates not analyzed for
 (F) indicates field duplicate
 < indicates sample result is below specific MDA

Table 5-4 : Sediment Samples Results (continued)

Station	Date	Thorium-232	Thorium-228	Radium-224	Lead-212	Bismuth-212	Thallium-208
Site Specific Background		2.76	2.37	0.88	2.26	—	0.71
Reference Level Concentration		7.76	7.37	5.88	7.26	5	5.71
WEIR 1S	May-95	0.29	<0.28	<7.64	0.3	<1.46	<0.19
WEIR 1S DUP (F)	May-95	—	—		0.45	<1.66	<0.33
WEIR 1S	May-97		—				
WEIR 2S	May-95	3.68	<3.03	<3.68	0.97	<2.07	0.62
WEIR 2S	May-97	1.83	1.08	<3.53	0.95	<5.85	0.4
WEIR 2S DUP (F)	May-95	—			0.84	<1.71	0.32
WEIR 3S	May-95	0.56	0.4	<2.48	0.29	<1.6	<0.22
WEIR 3S	May-97	0.79	0.87	<4.87	0.82	<7.13	<0.49
WEIR 3S DUP (F)	May-95	—	—	—	0.22	<1.53	<0.21
WEIR 4S	May-95	0.88	0.76	<2.65	1.15	<1.54	0.48
WEIR 4S	May-97	1.29	1.37	<10.13	1.47	<5.18	<0.53
WEIR 4S DUP (F)	May-95	—	—	<2.65	1.00	<1.57	0.41
WEIR 5S	Apr-96	3.37	0.45	<3.09	<0.9	<3.27	<0.5
WEIR 5S	May-97	4.82	0.56	—	<1.19	<5.57	<0.46
WEIR 6S	Apr-96	1.54	0.89	<4.34	0.99	<1.62	0.37
WEIR 6S	May-97	2.09	1.29	—	<0.94	<6.29	0.49
WEIR 7S	Apr-96	0.97	2.03	<5.82	1.15	<1.9	<0.2
WEIR 7S	May-97	0.94	0.57	—	0.78	<6.05	<0.55
WEIR 8S	Apr-96	0.16	1.37	<2.14	<0.51	<2.8	<0.41
WEIR 8S	May-97	0.86	0.72	—	<0.69	<4.83	<0.49
WEIR 9S	Apr-96	1.94	47.8	<2.14	0.59	<1.77	.30
WEIR 9S	May-97	22.6	2.08	—	<0.98	<6.32	<0.49
SED 1 DUP	May-97	0.47	0.56	—	0.7	<5.34	<0.42
SED 1	May-97	0.57	0.65	—	<0.84	<5.23	<0.5
SED 2	May-97	0.24	0.2	—	<0.38	<3.22	<0.28
SED 3	May-97	0.92	1.17	—	<0.91	<5.89	<0.57
SED 4	May-97	0.84	0.74	—	0.84	<4.4	<0.21

Notes: All units are pCi/g

— indicates not analyzed for

(F) indicates field duplicate

< indicates sample result is below specific MDA

Table 5-5 : May 1997 Groundwater Monitoring Results and Historic Values From Background Wells

Well	Date	Filtered	Uranium-238	Uranium-234	Thorium-230	Radium-226	Uranium-235/236	Thorium-232	Radium-228	Thorium-228
May 1997 Groundwater Monitoring Results										
D-12	May-97	Filtered	0.23	0.22	0.14	0.49	0.08	0.02	0.47	<0.23
D-12DUP	May-97	Filtered	0.02	0.23	0.16	0.26	0.1	0	0.67	0.05
D-12	May-97	Unfiltered	0.14	0.23	0.2	0.54	0.003	0.042	0.62	0.04
D-3	May-97	Filtered	0.16	0.3	0.054	0.75	0.047	<0.002	2.55	0.1
D-3	May-97	Unfiltered	0.11	0.25	0.028	1.5	0.087	0	3.43	0.11
D-6	May-97	Filtered	0.063	0.13	0.13	1.8	0.049	0.012	3.6	0.16
D-6	May-97	Unfiltered	1.13	2.46	0.52	2.05	0.67	0.067	3.93	0.098
D-93	May-97	Filtered	0.047	0.19	2.69	1.18	0.041	0.08	2.59	0.03
D-93	May-97	Unfiltered	2.12	2.87	0.26	1.34	1.15	0.062	2.61	0.071
I-2	May-97	Filtered	0.14	0.26	0.38	0.98	<0.004	0.009	2.08	0.032
I-2	May-97	Unfiltered	0.27	0.45	0.29	1.05	0.049	0.026	2.58	0.043
I-2-DUP	May-97	Filtered	0.2	0.38	0.13	0.82	0.029	0.011	1.69	0.098
I-2-DUP	May-97	Unfiltered	0.31	1.13	0.14	1.09	0.08	0.015	1.98	0.038
I-4	May-97	Filtered	0.04	0.11	0.005	0.81	0.019	0.009	1.11	0.039
I-4	May-97	Unfiltered	0.078	0.1	0.18	1.04	0.017	0.032	2.21	0.063
S-82	May-97	Filtered	1.13	1.5	0.18	1.07	0.1	<0.004	1.39	<0.015
S-82	May-97	Unfiltered	1.48	1.73	0.55	1.06	0.18	0.085	1.07	0.048
S-82DUP	May-97	Unfiltered	1.37	1.21	0.73	0.76	0.12	0.093	1.31	0.023
Background Monitoring Wells										
S-80	Nov-95	Filtered	0.49	0.88	0.61	34.9	0.4	--	--	--
S-80	Nov-95	Unfiltered	1.69	2.72	--	--	0.28	--	--	--
MW-107	Nov-95	Filtered	0.68	1.03	2.63	33.7	0.5			
MW-107	Nov-95	Unfiltered			1.61	36.8		1.05		

Notes: All units are pCi/g

-- indicates not analyzed for

(F) indicates field duplicate

< indicates sample result is below specific MDA

Table 5-6 : Groundwater Radon-226 Data
Comparison

Well	Date	Filtered	Radium-226
D-12	Nov-95	Filtered	--
D-12	Nov-95	unfiltered	--
D-12	Feb-96	Filtered	--
D-12	Feb-96	unfiltered	0.5
D-12	May-96	Filtered	0.36
D-12	May-96	unfiltered	0.73
D-12	May-97	Filtered	0.49
D-12	May-97	Filtered	0.26
D-12	May-97	unfiltered	0.54
D-3	Nov-95	Filtered	--
D-3	Nov-95	unfiltered	--
D-3	Feb-96	Filtered	--
D-3	Feb-96	unfiltered	2.7
D-3	May-96	Filtered	0.78
D-3	May-96	unfiltered	1.19
D-3 DUP (F)	May-96	Filtered	1.17
D-3 DUP (F)	May-96	unfiltered	1.21
D-3	May-97	Filtered	0.75
D-3	May-97	unfiltered	1.5
D-6	Nov-95	Filtered	--
D-6	Nov-95	unfiltered	--
D-6	Feb-96	Filtered	--
D-6	Feb-96	unfiltered	1.78
D-6	May-96	Filtered	1.66
D-6	May-96	unfiltered	1.88
D-6	May-97	Filtered	1.8
D-6	May-97	unfiltered	2.05

Notes: All units are pCi/g
 -- indicates not analyzed for
 1997 values are highlighted (bold)
 < indicates sample result is below specific
 MDA

Well	Date	Filtered	Radium-226
D-93	Nov-95	Filtered	--
D-93	Nov-95	unfiltered	--
D-93	Feb-96	Filtered	--
D-93	Feb-96	unfiltered	1.43
D-93 DUP (F)	Feb-96	Filtered	--
D-93 DUP (F)	Feb-96	unfiltered	1.21
D-93	May-96	Filtered	0.95
D-93	May-96	unfiltered	2.09
D-93	May-97	Filtered	1.18
D-93	May-97	unfiltered	1.34
I-2	Nov-95	Filtered	--
I-2	Nov-95	unfiltered	--
I-2	Feb-96	Filtered	--
I-2	Feb-96	unfiltered	1.69
I-2	May-96	Filtered	1.17
I-2	May-96	unfiltered	1.44
I-2	May-97	Filtered	0.98
I-2	May-97	unfiltered	1.05
I-2-DUP	May-97	Filtered	0.82
I-2-DUP	May-97	unfiltered	1.09
I-4	Feb-96	Filtered	--
I-4	Feb-96	unfiltered	2.41
I-4	May-96	Filtered	0.87
I-4	May-96	unfiltered	1.5
I-4	May-97	Filtered	0.81
I-4	May-97	unfiltered	1.04
S-82	Nov-95	Filtered	--
S-82	Nov-95	unfiltered	--
S-82	Feb-96	Filtered	--
S-82	Feb-96	unfiltered	1.09
S-82	May-96	Filtered	0.88
S-82	May-96	unfiltered	1.39
S-82	May-97	Filtered	1.07
S-82	May-97	unfiltered	1.06
S-82	May-97	unfiltered	0.76

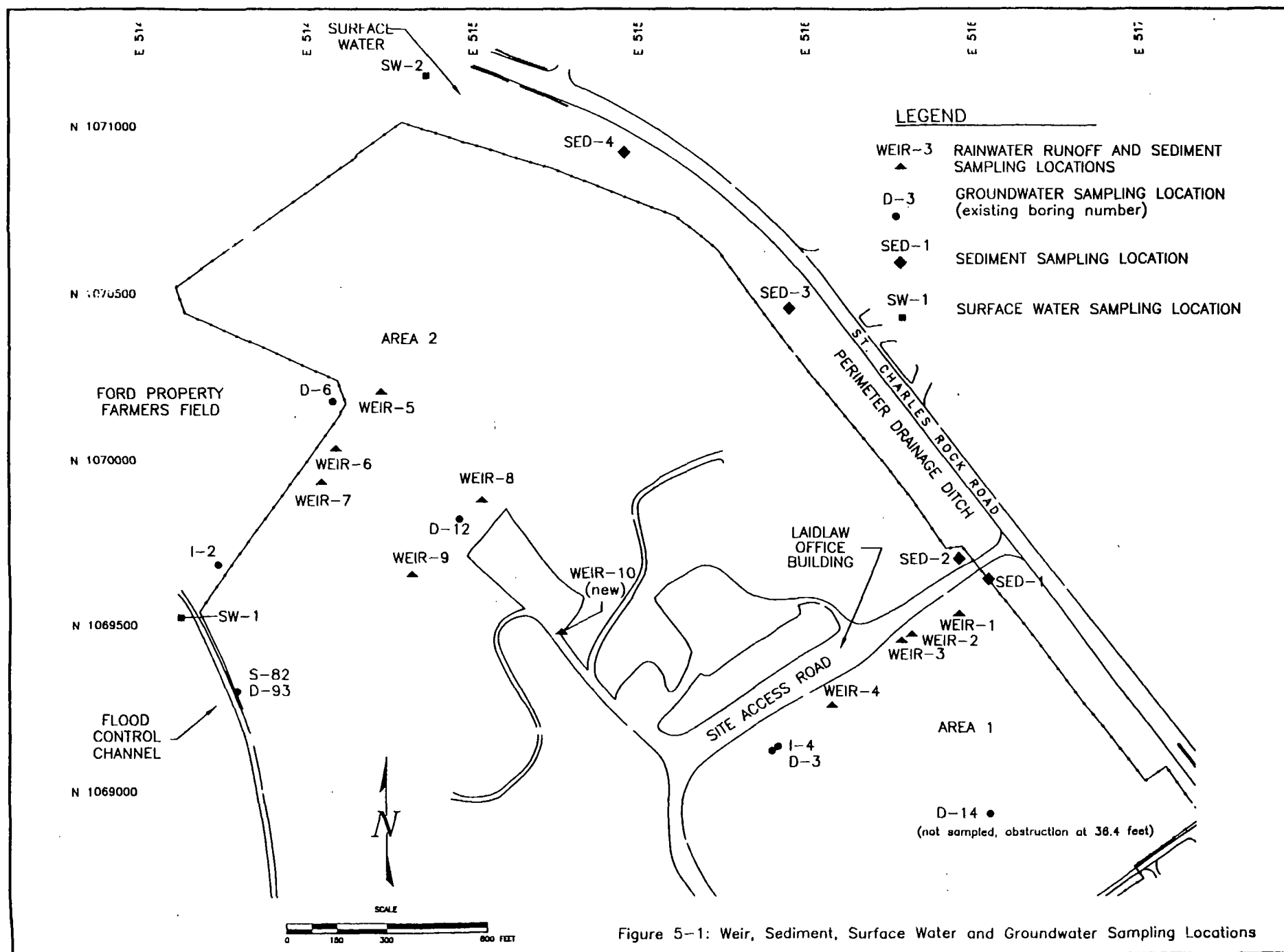


Figure 5-1: Weir, Sediment, Surface Water and Groundwater Sampling Locations

6. SUMMARY – REVISED CONCEPTUAL MODEL

This section summarizes the Site conditions and presents a revised conceptual model based upon the information presented in this report. This section also discusses the possible need for fate and transport modeling to assist in the completion of the RI and the BRA.

6.1 Summary of Site Conditions- Revised Conceptual Model

6.1.1 Surface Setting

The Site is situated on the eastern edge of the Missouri River floodplain approximately two miles east of the river. The river is separated from the Site area by a levee system.

Site elevations range from approximately 450 to 500 feet; however, the Site topography has been significantly altered by quarry activities in the eastern portion of the Site, and by placement of mine spoils and landfill materials in the eastern and western portion of the Site.

Area 1 is situated on the north and western slopes of a topographic high within the landfill. Ground surface elevation varies from 490 feet on the south to 452 feet at the roadway near the Site property entrance.

Area 2 is situated between a topographic high of landfilled materials on the south and the Ford property on the north. The topographic high in this area is about 500 feet on the southwest side of Area 2 sloping to approximately 470 feet near the top of the landfill berm along the south side of the Ford property. The upper surface of Area 2 is located approximately 20 to 30 feet above the adjacent Ford property and approximately 30 to 40 feet higher than the water surface in the flood control channel located to the southeast of Area 2. A berm on the northern portions of Area 2 controls runoff to the adjacent properties.

Surface runoff from Area 1 ultimately flows north to a drainage ditch, east to the drainage ditch on the southwest side of St. Charles Rock Road and then north to a surface water body within the drainage system and north of Area 2. Runoff from Area 2 generally flows into an internal closed topographic depression within Area 2. Some of the southern part of Area 2 drains into on-site drainage ditches that route the water to the St. Charles Rock Road drainage system. A very small area drains through a breach in the landfill berm for a limited distance onto the Ford property. No runoff from Area 2 flows into the flood control channel.

Land use in the area surrounding the Site is commercial and industrial. Deed restrictions have been recorded against the entire Site to prevent residential development from occurring. The southernmost portion of the Site is permitted for active sanitary landfill operations (Permit No.118912).

The property to the north of the Site, across St. Charles Rock Road, is moderately developed with commercial, retail and manufacturing operations. The Earth City industrial park is located adjacent to the Site on the west, across Old St. Charles Rock Road. The nearest residential development, "Spanish Village", is located to the south of the Site near the intersection of St. Charles Rock Road and I-270 approximately ¾ mile from Area 1 and 1 mile from Area 2. Mixed commercial, retail, manufacturing and single family residential uses are present to the southeast of the Site. The land use zoning for the Site and surrounding area is shown on Figure 3-4.

Three types of plant communities were identified in Areas 1 and 2. These include old field and hydrophilic plant communities identified in both Areas 1 and 2 and a forest plant community identified in Area 2 only. A fourth plant community, a maintained field community, was identified in areas adjacent to the Site. These areas are maintained by mowing at frequency of at least once per year. No sensitive species or communities are known to occur on the immediate Site or surrounding area.

6.1.2 Subsurface Setting

The geology of the Site area consists of Paleozoic age sedimentary rocks overlying Pre-Cambrian age igneous and metamorphic rocks. The Paleozoic bedrock is overlain by unconsolidated alluvial and loess deposits of recent (Holocene) age.

The uppermost bedrock units in the vicinity of the Site consist of Mississippian age limestone and dolomite with inter-bedded shale and siltstone layers of the Kinderhookian, Osagean, and Meramecian Series. The Kinderhookian Series is an undifferentiated limestone, dolomitic limestone, shale and siltstone unit ranging in thickness from 0 to 122 feet in the St. Louis area. The Osagean Series consists of the Fern Glen Formation, a red limestone and shale, and the Burlington-Keokuk Formation, a cherty limestone. The Fern Glen Formation ranges in thickness from 0 to 105 feet and the Burlington-Keokuk Formation ranges from 0 to 240 feet thick in the St. Louis Area.

Groundwater is present in both the bedrock units and the unconsolidated materials. The major bedrock aquifers of the St. Louis area include the Cambrian-age Potosi Dolomite and the Ordovician-age Gasconade Dolomite, Roubidoux Formation and St. Peter Sandstone.

The Potosi Dolomite can be present in thicknesses of up to 324 feet at an average depth of 2,240 feet in the St. Louis area. The Gasconade Dolomite and the associated

Gunter Sandstone occur in thickness of up to 280 feet in the St. Louis area. These units are overlain by the Roubidoux Formation which ranges from 0 to 177 feet thick in the St. Louis area. The average depth of the Roubidoux Formation is approximately 1,930 feet. The St. Peter Sandstone lies at a depth of approximately 1,450 feet below ground surface and can be as much as 160 feet thick. Due to their depth, these formations are generally not used as a source of potable water. The deeper Cambrian and Ordovician-age aquifers are separated from shallower units by the Ordovician-age Maquoketa shale that appears to provide confinement for the underlying deeper aquifers.

Areas 1 and 2 are underlain by alluvial deposits of varying thickness. The landfill debris varies in thickness from 5 to 56 feet, with an average thickness of approximately 36 feet in Area 1 and approximately 30 feet in Area 2. The underlying alluvium increases in thickness from east to west beneath Area 1. The alluvial thickness beneath the southeastern portion of Area 1 is less than 5 feet (bottom elevation of 420 feet AMSL) while the thickness along the northwestern edge of Area 1 is approximately 80 feet (bottom elevation of 370 feet AMSL). The thickness of the alluvial deposits beneath Area 2 is fairly uniform at approximately 100 feet (bottom elevation of 335 feet AMSL).

During the RI investigations, groundwater was generally encountered in the underlying alluvium near or immediately below the base of the landfill debris. Isolated bodies of perched water were encountered in two of the 24 soil borings drilled in Area 1 and six of the 40 soil borings drilled in Area 2 as part of the RI field investigations. The perched water generally occurs in small isolated units at depths varying from five to 30 feet below ground surface.

Monthly groundwater levels measured in various Site wells indicate that groundwater generally occurs only in the underlying alluvium at or below the base of the landfill materials with the exception of the localized perched water conditions encountered in isolated areas within the landfill. Groundwater elevations varied seasonally and were generally lowest during the fall and winter months (September through March) and highest during the spring and summer months (April through August).

The RI data indicate that only a very small amount of relief (less than one foot) exists in the water table surface beneath the landfill. Based on the water level data, the inferred direction of groundwater flow beneath Area 1 is to the south toward the active landfill.

No public water supply wells that obtain water from the alluvial aquifer are present near the Site. The distribution of private wells in the vicinity of the Site is as follows:

- Four wells are located less than one mile from the Site; however, two no longer exist and the remaining two are not used as drinking water sources;

- Seventeen wells located between one and two miles from the Site including four wells used for irrigation purposes, one well at an abandoned Site, and twelve wells used as drinking water sources; and
- Five wells located between two and three miles from the Site, all of which are used as drinking water sources.

The nearest well reportedly used as a drinking water source is located approximately 5,300 feet to the north of the Site (Foth & Van Dyke, 1989). The number of private wells has likely decreased since preparation of the Foth & Van Dyke, 1989 report due to urban and suburban development and flooding of some of the areas in 1993 and 1995.

6.2 Contaminant Sources

The radionuclides are dispersed throughout the upper part of the landfill deposits in Area 1 and Area 2. Approximately 88,900 square feet (2 acres) of Area 1 has radionuclides exposed at the surface (upper 6 inches). The quantity of these surficial materials is estimated at 650 tons. Approximately 198,000 square feet (4.6 acres) of Area 1 have radionuclides present in the subsurface to depths of 7 feet, with localized intervals present to depths of 15 feet. The quantity of subsurface impacted soils and associated materials including refuse, debris and fill materials is estimated at 24,400 tons based upon an average material thickness of 8.33 feet.

Approximately 504,000 square feet (11.6 acres) of Area 2 have radionuclides exposed at the surface. The quantity of these surficial materials is estimated at 3,700 tons. Approximately 785,000 square feet (18 acres) of Area 1 have radionuclides present in the subsurface to depths of 10 feet, with one localized interval present to a depth of 23 feet. The quantity of subsurface impacted soils and associated materials including refuse, debris and fill materials is estimated at 49,600 tons.

In general, the isotope values above reference levels originated from radionuclides from the uranium-238 and uranium-235 decay series. Thorium-232 and radium-224 isotopes from the thorium-232 decay series were also present above reference levels but at a lesser frequency. The subsurface samples generally contained more radionuclides at higher concentrations than the surface samples.

6.3 Potential Migration Pathways

The potential migration pathways identified in this report include:

- Airborne transport of radon gas and radionuclides in fugitive dust: Site specific measurement of radon flux, radon in landfill gas emanating from the flare, and of radionuclides on fugitive dust indicate negligible exposure to both on-site personnel as well as potential offsite receptors.
- Rainwater runoff transport of radionuclides in the on-site and offsite water: Some of the rainwater measured onsite did contain radionuclides above MCLs. None of the radionuclides were measured at levels above MCLs in the samples collected from the nearest offsite surface water sources.
- Transport of radionuclides in the on-site and offsite erosional sediments: Some of the sediment samples collected on-site did contain levels of radionuclides above reference levels. One sediment sample collected at the landfill boundary on the southern side of the access road contained radium-226 at a level slightly higher than the reference level. None of the offsite sediment samples contained radionuclides above the reference level.
- Sediment transport from the berm on the northwestern boundary of Area 2 onto the Ford property: Soil samples from five of the eleven locations on the Ford property contained radionuclides above the reference level. All of these samples were from the upper 3 inches of materials.
- Migration of water to seeps: Sampling results indicate that the radioisotopes in the leachate from the only identified seep are all below the Missouri State MCLs. Based upon this results, seeps do not appear to be a significant exposure pathway. There is no offsite exposure pathway because the water from the seeps does not migrate offsite.
- Migration of perched water or leachate seeps offsite: Potential exposure to perched water would either be through leachate seeps or groundwater. Leachate seeps area not a significant exposure pathway (see above). Groundwater is discussed below.
- Groundwater: There is no on-site usage of groundwater. Only one Site well contained radionuclides above the Missouri State MCLs and the measured concentrations were very near to the MCL. The potential for this exposure pathway to prove significant is very low given the distance to the nearest drinking water well and the fact that all surrounding businesses use municipal drinking water supplies.

6.4 Potential Exposure Pathways

Table 6-1 summarizes the preliminary assessment of potential pathways for OU-1. Direct contact to on-site personnel is the primary potential exposure pathway. There is a much lower potential for direct exposure to sediments in the drainage ditch north of Area 1 and northwest of Area 2 at the boundary with the Ford property. Finally, an extremely low potential exists for on-site exposure to radon gas and radionuclides in rainwater runoff. None of the other migration pathways, including atmospheric transport of fugitive dust, surface water and groundwater are viable exposure pathways. Table 6-1 will be reevaluated and revised as necessary as part of the BRA.

6.5 Fate and Transport Modeling

The data and interpretations included in this document indicate that potential offsite migration of radionuclides has been limited to:

- Sediment in the drainage ditch south of the main access road;
- Sediment laden rainwater to the northwest on the Ford property buffer; and
- Groundwater to the northwest of the Site beneath the Ford property buffer.

The extent of sediment migration along the access road and onto the Ford property have been defined to an acceptable degree for completion the RI, the BRA, and the FS. The radionuclide exceedance of the MCL in the groundwater is slight and has also been sufficiently defined to an acceptable degree for completion the RI, the BRA, and the FS.

Based upon this information, EMSI concludes that extensive fate and transport modeling will not be necessary to complete the BRA; however, some simulation using analytical solutions may be completed to evaluate short term attenuation in both air and water media. These needs will be addressed during completion of the BRA.

Table 6-1 : Summary of Potential Exposure Pathways for OU-1

Media	Carrier	On-Site Exposure Potential	Off-Site Exposure Potential	Comments
Air	Radon Gas from Surface Emissions	Very Low	Negligible	On-site exposure limited to two small regions in Area 1 and two small regions in Area 2.
	Radon Gas in landfill gas	Negligible	Negligible	Based upon results included in Golder (1993).
Soil	Surface Exposure	Low	Negligible	On-site exposure limited to infrequently visited regions in both Area 1 and Area 2. Off-site exposure limited to small area of the Ford property and a very limited reach of the south drainage of the access road immediately adjacent to the property boundary.
	Sediment Transport	Low	Negligible	On-site exposure limited to infrequently visited regions in both Area 1 and Area 2 and access road drainage ditch.
Surface Water	Rainwater Runoff	Very Low	Very low	On-site exposure limited to infrequently visited areas during precipitation events. Off-site exposure limited to small region of Ford property northwest of Area 2 that will probably be purchased by the Respondents to facilitate remediation.
Landfill Seep	Seep discharge	Negligible	Negligible	No radionuclides above Missouri MCLs
Groundwater	Groundwater	Negligible	Very Low	No on-site used of groundwater. Off-site migration believed to be limited to small region of Ford property northwest of Area 2 that will probably be purchased by the Respondents to facilitate remediation.

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APPENDIX A
COMPILATION OF ANALYTICAL DATA
COLLECTED BY McLaren/Hart and EMSI

Alluvial Hydraulic Conductivity Values

Monitoring Well	Hydraulic Conductivity K (cm/s) *		
Shallow Depth Wells			
S-1	3.78E-03		
S-5	8.76E-04	Max	3.43E-02
S-8	3.43E-02	Min	8.76E-04
S-84	2.32E-03	Avg	8.22E-03
MW-101	4.17E-03		
MW-F3	3.83E-03		
Intermediate Depth Wells			
I-2	3.27E-02		
I-4	5.41E-02	Max	6.68E-02
I-7	6.68E-02	Min	1.22E-02
I-9	5.47E-02	Avg	4.45E-02
I-11	4.63E-02		
I-68	1.22E-02		
Deep Depth Wells			
D-3	3.15E-02		
D-6	4.29E-02	Max	8.85E-02
D-12	4.14E-02	Min	4.50E-03
D-13	8.85E-02	Avg	4.28E-02
D-85	4.50E-03		
D-93	4.78E-02		

* All Hydraulic Conductivities were determined using the computer software program AQTESOLV™ (Geraghty & Miller, Inc. 1989). A graph of the data points was assigned a best fit line that was visually positioned on the graph.

TABLE 2 - 1
BACKGROUND SOIL RADIOLOGICAL ANALYTICAL RESULTS
URANIUM-238, URANIUM-235, THORIUM-232 DECAY SERIES
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g])

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration *																	
Surface Samples		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Subsurface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
Barrow Pit - loess	0	1.30	0.19	1.15	1.04	1.06	0.20	0.92	0.37	1.19	0.29	1.07	0.23	< MDA	-	2.40	1.31
Barrow Pit - shale	0	1.85	0.23	1.99	1.08	2.40	0.36	1.41	0.18	0.97	0.34	1.01	0.26	0.90	0.34	1.88	1.23
Farmer's Field	0	1.41	0.13	< MDA	-	1.11	0.20	2.03	0.17	1.13	0.33	1.62	0.33	1.27	0.33	3.16	2.04
McLaren/Hart Shop	0	0.74	0.14	< MDA	-	1.32	0.23	1.68	0.32	0.95	0.31	0.92	0.31	< MDA	-	< MDA	1.79

URANIUM-235 DECAY SERIES (picocuries per gram [pCi/g])

Boring	Depth (feet)	Uranium-235/236		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std. Dev)		1.15		NE		NE		NE	
Reference Level Concentration *									
Surface Samples		6.15		5		5		5	
Subsurface Samples		16.15		15		15		15	
Barrow Pit - loess	0	0.41	0.28	< MDA	1.36	< MDA	0.70	< MDA	--
Barrow Pit - shale	0	0.91	0.32	< MDA	4.13	< MDA	0.70	< MDA	--
Farmer's Field	0	0.02	0.22	< MDA	1.68	< MDA	1.34	< MDA	--
McLaren/Hart Shop	0	0.21	0.19	< MDA	4.33	< MDA	0.89	< MDA	--

THORIUM-232 DECAY SERIES (picocuries per gram [pCi/g])

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-230		Radium-224		Lead-212		Bismuth-212		Thallium-208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background (Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration *															
Surface Samples		6.66		7.37		6.33		5		7.26		5		5.71	
Subsurface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
Barrow Pit - loess	0	0.75	0.22	1.39	0.64	0.58	0.33	< MDA	-	1.33	0.18	< MDA	-	0.38	0.16
Barrow Pit - shale	0	1.26	0.14	1.90	0.64	1.16	0.13	< MDA	-	1.94	0.23	< MDA	-	0.63	0.18
Farmer's Field	0	1.05	0.1	< MDA	-	0.56	0.20	< MDA	-	0.80	0.36	< MDA	-	0.32	0.22
McLaren/Hart Shop	0	0.52	0.18	< MDA	-	0.43	0.34	< MDA	-	1.09	0.21	< MDA	-	0.41	0.18

* - Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides, they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

- - Not reported

NE - Not Established

DUP (F) - Field duplicate

DUP (L) - Laboratory duplicate

MDA - Minimum Detectable Activity

Bolded numbers indicate result reported above minimum detectable activity

TABLE 2-4
SUMMARY OF SOIL BORING LOCATIONS, ELEVATIONS, AND TERMINATION DEPTHS - AREA 1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

BORING DESIGNATION	PLANNED NORTHING	PLANNED EASTING	PLANNED ELEV.	DATE DRILLED	NORTHING	EASTING	ELEVATION (FL MSL)	TERMINATION DEPTH (FL bgs.)	DEPTH OF ELEVATED GAMMA READINGS (FL bgs.)		BASIS FOR TERMINATING BORING (eg. perched water, native alluvium, etc.)
									TOP	BOTTOM	
WL-101	1,069,529.56	516,273.13	457.72	8/4/95	1,069,549.55	516,317.21	456.5	25	NOT ENCOUNTERED		Alluvium
WL-102	1,069,270.53	515,975.83	461.91	8/4/95	1,069,260.46	515,974.05	462.8	34	2.0	4.0	Refusal; rock
WL-103	1,069,408.90	516,736.90	450.69	8/7/95	1,069,407.36	516,737.06	450.9	25	NOT ENCOUNTERED		Alluvium
WL-104	1,069,542.14	516,599.93	451.34	8/7/95	1,069,575.47	516,602.77	449.8	35	NOT ENCOUNTERED		Alluvium
WL-105 (D-3)	1,069,148.99	515,889.32	466.54	8/8/95-8/9/95	1,069,136.26	515,871.62	467.2	109	0.5	11.0	Monitoring Well
WL-105 (L-4)	1,069,148.99	515,889.32	466.54	8/10/95	1,069,148.42	515,889.50	466.0	79	4.5	9.0	Monitoring Well
WL-105 (S-5)	1,069,148.99	515,889.32	466.54	8/15/95	1,069,155.84	515,901.03	465.7	49	1.5	5.5	Monitoring Well
WL-106A	1,069,307.95	516,069.94	464.56	8/11/95	1,069,301.64	516,082.18	465.4	20	2.5	5.0	Landfill. Relocate to investigate elevated gamma readings.
WL-106B	1,069,307.95	516,069.94	464.56	8/11/95	1,069,317.25	516,061.92	462.8	35	0.0	1.0	Alluvium
WL-107	1,068,908.00	516,264.96	486.91	9/5/95	1,068,909.52	516,254.31	486.1	52	NOT ENCOUNTERED		Alluvium
WL-108	1,069,152.01	516,395.95	472.76	9/5/95	1,069,144.21	516,379.68	472.5	22	NOT ENCOUNTERED		Perched water encountered at 16'
WL-109A	1,068,947.01	516,522.00	485.82	9/6/95	1,068,932.92	516,509.67	485.5	50	NOT ENCOUNTERED		Alluvium
WL-109B (D-14)	1,068,947.01	516,522.00	485.82	9/7/95-9/11/95	1,068,947.16	516,523.17	484.5	52	NOT ENCOUNTERED		Alluvium
WL-109C	1,068,947.01	516,522.00	485.82	9/12/95	1,068,961.12	516,528.43	483.9	57	NOT ENCOUNTERED		Refusal; rock
WL-109D	1,068,947.01	516,522.00	485.82	9/12/95-9/13/95	1,068,947.38	516,504.97	485.6	60	NOT ENCOUNTERED		Alluvium
WL-110	1,068,889.01	516,645.03	484.41	9/6/95	1,068,889.01 ¹	516,645.03 ¹	484.41 ¹	56	NOT ENCOUNTERED		Alluvium; elevated temperature
WL-111	1,069,176.92	516,589.23	475.06	9/11/95	1,069,187.35	516,583.61	474.5	52	NOT ENCOUNTERED		Alluvium
WL-112	1,069,407.80	516,599.06	466.56	9/11/95	1,069,379.45	516,628.22	467.6	42	NOT ENCOUNTERED		Alluvium
WL-113	1,069,499.99	516,468.98	465.79	9/25/95	1,069,483.19	516,469.95	467.0	45	3.5	4.0	Alluvium
WL-114	1,069,409.53	516,335.24	467.40	9/25/95	1,069,391.53	516,338.57	468.3	45	4.0	5.0	Alluvium
WL-115	1,069,292.95	516,401.47	469.01	9/26/95	1,069,298.98	516,395.13	468.9	41	NOT ENCOUNTERED		Alluvium
WL-116	1,069,078.99	516,165.99	474.46	9/26/95	1,069,083.49	516,160.60	474.3	20	NOT ENCOUNTERED		Perched water encountered at 8'
WL-117	1,069,224.01	516,221.97	467.98	9/27/95	1,069,237.40	516,221.33	467.6	41	6.0	7.0	Alluvium
WL-118	1,069,409.53	516,335.24	467.40	9/28/95	1,069,411.09	516,304.95	465.8	15	NOT ENCOUNTERED		Landfill; terminated - high gamma not encountered
WL-119	1,069,031.14	516,289.26	477.40	9/29/95	1,069,031.14	516,289.26	477.4	50	NOT ENCOUNTERED		Alluvium
WL-120	1,069,060.99	516,771.00	472.51	9/29/95	1,069,053.64	516,846.57	474.7	52	NOT ENCOUNTERED		Landfill; terminated - elevated temperature

¹ Planned location, not surveyed
() - Monitoring well designation
Fl. MSL - feet above mean sea level
Fl. bgs. - feet below ground surface

TABLE 2-5
SUMMARY OF SOIL BORING LOCATIONS, ELEVATIONS AND TERMINATION DEPTHS - AREA 2
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

BORING DESIGNATION	DATE DRILLED	NORTHING	EASTING	ELEVATION (FL MSL)	TERMINATION DEPTH (FT)	DEPTH OF ELEVATED GAMMA READINGS (Ft bgs.)		BASIS FOR TERMINATING BORING (eg. perched water, native alluvium, etc.)
						TOP	BOTTOM	
WL-201	7/31/95	1,070,378.84	514,177.60	444.0	15	NOT ENCOUNTERED		Alluvium
WL-202	7/31/95	1,070,102.59	514,488.27	444.9	15	NOT ENCOUNTERED		Alluvium
WL-203	7/31/95	1,069,934.54	514,237.48	444.7	15	NOT ENCOUNTERED		Alluvium
WL-204 (S-1)	8/1/95	1,069,685.83	514,205.01	443.2	25	NOT ENCOUNTERED		Monitoring Well (Shallow)
WL-205 (I-2)	8/1/95-8/3/95	1,069,698.26	514,212.18	443.2	52	NOT ENCOUNTERED		Monitoring Well (Intermediate)
WL-206 (D-6)	8/16/95-8/17/95	1,070,194.31	514,549.50	444.4	109	NOT ENCOUNTERED		Monitoring Well (Deep)
WL-207 (I-7)	8/18/95	1,070,743.05	514,299.87	444.5	50	NOT ENCOUNTERED		Monitoring Well
WL-208	8/23/95-8/25/95	1,070,141.19	514,752.42	474.8	37	NOT ENCOUNTERED		Alluvium
WL-209	8/24/95	1,070,492.55	514,686.34	467.4	30	0.0	4.0	Alluvium
WL-210	8/25/95-8/28/95	1,069,775.15	514,811.55	477.8	53	0.0	12.0	Alluvium
WL-211	8/28/95	1,070,046.08	514,684.07	475.3	28	0.0	10.0	Alluvium
WL-212	8/28/95	1,070,025.86	514,973.26	472.9	30	NOT ENCOUNTERED		Alluvium
WL-213	8/29/95	1,070,223.38	514,947.61	472.3	25	NOT ENCOUNTERED		Alluvium
WL-214	8/29/95	1,070,206.86	515,241.19	468.5	25	NOT ENCOUNTERED		Alluvium
WL-215	8/29/95	1,070,432.01	515,259.72	470.0	16	NA		Perched water at 6'
WL-216A(D-12)	8/29/95	1,069,836.29	514,936.08	477.4	25	2.5	5.0	Alluvium
WL-216B(S-10)	8/30/95	1,069,827.87	514,931.35	477.5	23	3.0	5.0	Alluvium
WL-216C(I-11)	8/30/95	1,069,819.16	514,925.06	477.6	30	2.0	6.0	Alluvium
WL-217	8/30/95	1,069,961.30	515,082.21	474.7	17	NOT ENCOUNTERED		Perched water at 12'
WL-218	8/30/95	1,069,462.69	514,839.09	489.7	37	NOT ENCOUNTERED		Alluvium
WL-219A	8/31/95	1,069,142.47	514,545.63	496.7	27	NOT ENCOUNTERED		Perched water at 21'
WL-220	8/31/95	1,069,258.11	514,733.38	503.9	30	NOT ENCOUNTERED		perched water at 23'
WL-221	9/1/95	1,070,567.35	514,459.37	462.3	35	NOT ENCOUNTERED		Alluvium
WL-222	9/1/95	1,070,799.38	514,618.74	457.8	35	NOT ENCOUNTERED		Alluvium
WL-223	9/5/95	1,070,745.71	514,734.14	462.2	23	3.5	5.5	Alluvium
WL-224(D-13)	9/14/95	1,070,485.74	515,601.73	468.4	36	NOT ENCOUNTERED		Alluvium
WL-225	9/14/95	1,070,576.93	515,632.66	468.2	35	NOT ENCOUNTERED		Perched water at 31'
WL-226	9/15/95	1,070,536.03	514,992.10	467.5	43	2.5	3.5	Alluvium
						9.0	16.0	
WL-227	9/15/95	1,070,685.99	515,258.39	462.0	40	NOT ENCOUNTERED		Alluvium
WL-228(S-8)	9/15/95	1,071,044.35	514,724.16	441.6	29	NOT ENCOUNTERED		Monitoring Well
WL-229(I-9)	9/18/95	1,069,329.26	514,268.59	448.5	56	NOT ENCOUNTERED		Monitoring Well
WL-230	9/18/95	1,070,716.09	515,139.66	463.3	35	NOT ENCOUNTERED		Alluvium
WL-231	9/18/95	1,070,850.73	515,007.27	464.8	40	4.5	6.0	Alluvium
WL-233	9/19/95	1,069,542.40	514,609.19	489.2	43	20.0	24.0	Alluvium
WL-234	9/19/95	1,069,757.62	514,428.12	480.0	42	4.0	9.0	Alluvium
WL-235	9/20/95	1,069,615.23	514,418.87	481.1	30	22.0	23.0	Water @ 25'
WL-236	9/21/95	1,069,399.29	514,384.13	484.3	37	NOT ENCOUNTERED		Water @ 37'
WL-237	9/21/95	1,070,069.42	515,161.88	473.9	40	NOT ENCOUNTERED		Alluvium
WL-238	9/21/95	1,070,705.96	514,916.28	466.2	34	5.0	7.0	Alluvium
WL-239	9/27/95	1,070,921.77	514,829.72	458.9	30	NOT ENCOUNTERED		Water @ 28'
WL-240	9/28/95	1,070,320.97	515,315.69	468.5	11	NOT ENCOUNTERED		Water @ 5'
WL-241	9/28/95	1,070,319.84	515,100.73	469.6	40	4.5	8.5	Alluvium
WL-242	12/13/95	NS	NS	NS	2.0	NA		Surface sample
WL-243	12/13/95	NS	NS	NS	0.5	NA		Surface sample
WL-244	12/13/95	NS	NS	NS	0.5	NA		Surface sample
WL-245	12/13/95	NS	NS	NS	0.5	NA		Surface sample
WL-246	12/13/95	NS	NS	NS	0.5	NA		Surface sample

NS - Not surveyed

() - Monitoring well designation

Ft. MSL - feet above mean sea level

Ft. bgs. - feet below ground surface

NA - Not available. Boring not downhole gamma logged.

Table 2 - 7a
Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background (Mean±2 Std Dev)		1.15		NE		NE		NE		NE	
Reference Level Concentration *		6.15		5		5		5		5	
Surface Samples		16.15		15		15		15		15	
Subsurface Samples											
AREA 1											
WL-101	5	0.13	0.11	<MDA	0.72	<MDA	4.25	<MDA	0.77	<MDA	11.45
	20	<MDA	0.16	<MDA	0.54	<MDA	3.15	<MDA	0.69	<MDA	8.49
WL-102	5	<MDA	0.16	<MDA	0.49	<MDA	3.79	<MDA	0.74	<MDA	8.77
	15	<MDA	0.09	<MDA	0.83	<MDA	4.62	<MDA	1.04	<MDA	13.54
WL-103	5	0.21	0.16	<MDA	0.73	<MDA	4.52	<MDA	0.89	<MDA	9.63
	10	0.23	0.16	<MDA	1.41	<MDA	8.51	<MDA	1.40	<MDA	15.56
WL-104	5	<MDA	0.18	<MDA	0.55	<MDA	2.80	<MDA	0.60	<MDA	7.84
	20	0.25	0.12	<MDA	0.56	<MDA	3.60	<MDA	0.59	<MDA	6.49
WL-105	10	0.55	0.14	3.95	1.97	26.9	10.0	15.0	1.9	16.8	6.3
	30	<MDA	0.11	<MDA	0.73	<MDA	4.99	<MDA	0.88	<MDA	9.36
WL-106	0	6.86	3.10	75.5	8.7	544	41	305	8	293	25
	5	<MDA	3.87	2.10	1.12	11.1	5.9	6.3	1.73	6.67	3.90
	5 DUP (L)	-	-	-	-	-	-	-	-	<MDA	5.80
	5 DUP (F)	<MDA	25.5	12.1	3.4	73.2	16.9	43.8	3.20	44.3	10.0
	25	0.24	0.07	<MDA	0.78	<MDA	4.41	<MDA	0.81	<MDA	9.87
	25 DUP (F)	<MDA	0.14	<MDA	1.14	<MDA	5.51	<MDA	1.34	<MDA	11.06
WL-107	5	<MDA	0.11	<MDA	0.58	<MDA	3.81	<MDA	0.71	<MDA	13.99
	51	<MDA	0.095	<MDA	0.63	<MDA	4.11	<MDA	0.85	<MDA	15.08
	51 DUP (L)	<MDA	0.11	<MDA	0.63	<MDA	4.42	<MDA	1.08	<MDA	13.37
WL-108	5	<MDA	0.13	<MDA	0.67	<MDA	4.43	<MDA	0.96	<MDA	13.65
WL-109	5	<MDA	0.09	<MDA	0.61	<MDA	3.91	<MDA	0.70	<MDA	14.48
	50	<MDA	0.14	<MDA	0.77	<MDA	4.35	<MDA	1.22	<MDA	9.22
	50 DUP (L)	0.09	0.12	<MDA	1.28	<MDA	6.61	<MDA	1.68	<MDA	15.02
WL-110	5	<MDA	0.08	<MDA	0.84	<MDA	5.20	<MDA	1.26	<MDA	14.87
	50	<MDA	0.25	<MDA	0.74	<MDA	4.39	<MDA	1.23	<MDA	10.36
WL-111	0	0.72	0.23	<MDA	0.70	<MDA	4.20	<MDA	1.05	<MDA	14.77
	5	<MDA	1.49	<MDA	0.70	<MDA	4.22	<MDA	1.11	<MDA	21.48
	5 DUP (L)	-	-	-	-	<MDA	4.92	<MDA	1.19	<MDA	27.47
	51	<MDA	0.35	<MDA	0.64	<MDA	3.64	<MDA	0.64	<MDA	20.60
	51 DUP (L)	-	-	-	-	<MDA	4.74	<MDA	0.89	<MDA	23.32

Table 2 - 7a
Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background (Mean±2 Std Dev)		1.15		NE		NE		NE		NE	
Reference Level Concentration *		6.15		5		5		5		5	
Surface Samples		16.15		15		15		15		15	
Subsurface Samples		16.15		15		15		15		15	
WL-112	0	0.24	0.17	<MDA	0.85	<MDA	5.45	<MDA	1.32	<MDA	16.78
	5	<MDA	1.1	<MDA	0.99	<MDA	6.84	<MDA	1.59	<MDA	36.70
	42	0.83	0.56	<MDA	0.56	<MDA	3.52	<MDA	0.66	<MDA	21.75
WL-113	5	0.60	0.24	<MDA	0.23	<MDA	1.01	<MDA	0.32	<MDA	3.26
	5 DUP (F)	<MDA	0.19	<MDA	0.17	<MDA	0.72	<MDA	0.17	<MDA	2.88
	10	0.27	0.23	<MDA	0.42	<MDA	2.09	<MDA	0.62	<MDA	7.47
WL-114	0	19.5	1.1	17.6	3.0	156	14	118	3	113	8
	5	0.82	0.51	0.32	0.27	1.93	1.09	1.2	0.22	<MDA	4.77
	5 DUP (L)	-	-	-	-	2.42	1.35	1.07	0.28	<MDA	4.68
	15	<MDA	0.44	<MDA	0.24	<MDA	1.08	<MDA	0.35	<MDA	3.71
	15 DUP (L)	-	-	-	-	<MDA	1.34	<MDA	1.48	<MDA	4.41
WL-115	5	0.47	0.31	<MDA	0.15	<MDA	0.85	<MDA	0.18	<MDA	2.77
	40	<MDA	0.13	<MDA	0.13	<MDA	0.67	<MDA	0.14	<MDA	2.21
WL-116	0	<MDA	0.20	<MDA	1.02	<MDA	5.57	<MDA	1.38	<MDA	21.59
	5	<MDA	0.52	<MDA	0.17	<MDA	0.89	<MDA	0.19	<MDA	2.89
	5 DUP (F)	<MDA	0.24	<MDA	0.44	<MDA	2.26	<MDA	0.68	<MDA	7.64
	10	<MDA	0.10	<MDA	0.13	<MDA	0.69	<MDA	0.14	<MDA	2.23
WL-117	10	<MDA	0.25	0.30	0.27	<MDA	1.45	0.79	0.23	1.03	0.78
	25	<MDA	0.25	<MDA	0.20	<MDA	0.94	<MDA	0.27	<MDA	2.93
WL-118	5	1.46	0.10	2.40	1.41	28.3	5.4	18.5	1.2	16.1	3.4
	10	<MDA	0.18	0.18	0.15	0.90	0.82	0.41	0.14	<MDA	2.42
WL-119	5	<MDA	0.27	<MDA	0.15	<MDA	0.82	<MDA	0.16	<MDA	2.07
	50	<MDA	0.65	<MDA	0.12	<MDA	0.63	<MDA	0.13	<MDA	1.74
	50 DUP (L)	-	-	-	-	<MDA	0.99	<MDA	0.31	<MDA	2.71
	50 DUP (F)	<MDA	0.31	<MDA	0.13	<MDA	0.71	<MDA	0.14	<MDA	1.86
WL-120	5	0.33	0.24	<MDA	0.24	<MDA	1.20	<MDA	0.40	<MDA	3.20
	50	<MDA	0.12	<MDA	0.37	<MDA	1.96	<MDA	0.59	<MDA	5.06
	50 DUP (F)	<MDA	0.53	<MDA	0.25	<MDA	1.33	<MDA	0.41	<MDA	3.24

Table 2 - 7a
Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean±2 Std Dev)		1.15		NE		NE		NE		NE	
Reference Level Concentration *											
Surface Samples		6.15		5		5		5		5	
Subsurface Samples		16.15		15		15		15		15	
BACKGROUND SURFACE SOIL											
Barrow Pit - loess	0	0.41	0.28	< MDA	0.53	< MDA	3.36	< MDA	0.70	< MDA	16.33
Barrow Pit - shale	0	0.91	0.52	< MDA	0.56	< MDA	4.13	< MDA	0.70	< MDA	18.38
Farmer's Field	0	0.02	0.22	< MDA	0.77	< MDA	5.68	< MDA	1.34	< MDA	21.16
McLaren/Hart Shop	0	0.21	0.19	< MDA	0.73	< MDA	4.33	< MDA	0.89	< MDA	20.00

* - Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically if they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and samples have been conservatively selected for comparison of the data.

-- = Not reported

DUP (F) = Field duplicate

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

NE = Not Established

Bolded numbers indicate result reported above the minimum detectable activity.

Table 2 - 7b
Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background (Mean±2 Std Dev)		1.15		NE		NE		NE		NE	
Reference Level Concentration *											
Surface Samples		6.15		5		5		5		5	
Subsurface Samples		16.15		15		15		15		15	
AREA 2											
WL-201	5	<MDA	0.22	<MDA	4.1	<MDA	4.1	<MDA	0.82	<MDA	14.43
	15	<MDA	0.13	<MDA	4.09	<MDA	4.09	<MDA	0.83	<MDA	12.87
WL-202	5	<MDA	0.17	<MDA	1.30	<MDA	8.28	<MDA	1.64	<MDA	22.41
	5 DUP (L)	0.16	0.16	<MDA	0.56	<MDA	3.47	<MDA	0.59	<MDA	12.26
	15	<MDA	0.12	<MDA	1.24	<MDA	7.34	<MDA	1.4	<MDA	21.01
WL-203	0	0.31	0.27	<MDA	0.64	<MDA	4.76	<MDA	0.85	<MDA	18.79
	5	0.18	0.15	<MDA	0.75	<MDA	3.9	<MDA	1.14	<MDA	14.22
	15	<MDA	0.16	<MDA	0.68	<MDA	4.99	<MDA	0.85	<MDA	13.76
WL-204	5	0.22	0.15	<MDA	0.56	<MDA	3.81	<MDA	0.73	<MDA	11.67
	25	<MDA	0.11	<MDA	0.56	<MDA	3.51	<MDA	0.69	<MDA	11.34
WL-205	5	0.15	0.15	<MDA	0.61	<MDA	3.96	<MDA	0.67	<MDA	10.14
	15	0.18	0.14	<MDA	0.75	<MDA	3.06	<MDA	0.93	<MDA	13.34
WL-206	0	<MDA	0.33	1.70	1.04	7.93	0.72	6.15	1.11	6.73	4.03
	0 DUP (L)	-	-	-	-	-	-	-	-	8.75	6.60
	5	0.19	0.06	<MDA	1.44	<MDA	8.27	<MDA	1.75	<MDA	11.18
	10	<MDA	0.064	<MDA	0.60	<MDA	3.2	<MDA	0.67	<MDA	5.49
WL-207	5	<MDA	0.22	<MDA	1.27	<MDA	6.72	<MDA	1.76	<MDA	14.36
	5 DUP (L)	<MDA	0.24	<MDA	0.58	<MDA	3.29	<MDA	0.64	<MDA	7.47
	10	<MDA	0.25	<MDA	0.61	<MDA	3.74	<MDA	0.63	<MDA	6.46
WL-208	5	0.16	0.13	<MDA	1.18	<MDA	5.9	<MDA	1.22	<MDA	10.24
	5 DUP (L)	0.03	0.14	<MDA	1.04	<MDA	3.56	1.40	0.91	<MDA	7.64
	9	<MDA	0.18	<MDA	0.77	<MDA	4.40	<MDA	1.13	<MDA	7.38
WL-209	0	251	0.7	263	33	2030	160	1320	31	1097	98
	5	72.4	0.16	74.8	23.8	1930	122	1180	22	900	74
	5 DUP (F)	115	0.14	62.6	13.4	1200	71	1070	15	982	43
	25	<MDA	0.17	<MDA	0.84	<MDA	4.81	<MDA	0.86	<MDA	8.56
	25 DUP (F)	<MDA	0.12	<MDA	0.70	<MDA	3.63	<MDA	1.06	<MDA	7.65
WL-210	0	49.7	0.7	182	14	838	67	732	13	660	41
	5	15.5	0.17	<MDA	10.12	348	51	220	9	171	31
	5 DUP (F)	43.8	0.16	27.2	3.4	164	27	156	5	147	17
	40	<MDA	0.15	<MDA	0.78	<MDA	4.20	<MDA	1.07	<MDA	8.18
	40 DUP (F)	0.25	0.14	<MDA	1.50	<MDA	8.24	<MDA	1.73	<MDA	13.95
WL-211	5	0.22	0.13	<MDA	0.75	<MDA	3.46	2.48	0.87	<MDA	9.08
	25	<MDA	0.20	<MDA	0.79	<MDA	4.14	<MDA	0.88	<MDA	9.46

Table 2 - 7b
Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background (Mean±2 Std Dev)		1.15		NE		NE		NE		NE	
Reference Level Concentration *											
Surface Samples		6.15		5		5		5		5	
Subsurface Samples		16.15		15		15		15		15	
WL-212	5	<MDA	0.16	<MDA	1.15	<MDA	6.80	<MDA	1.38	<MDA	12.42
	10	<MDA	0.15	<MDA	0.56	<MDA	3.71	<MDA	0.78	<MDA	8.69
WL-213	0	0.45	0.58	<MDA	0.88	<MDA	5.11	<MDA	1.03	<MDA	18.42
	5	<MDA	0.15	<MDA	0.83	<MDA	4.84	<MDA	1.01	<MDA	9.36
	25	<MDA	0.17	<MDA	1.35	<MDA	7.02	<MDA	1.59	<MDA	15.23
WL-214	5	0.81	0.14	<MDA	0.52	<MDA	3.52	<MDA	0.55	<MDA	7.54
	25	<MDA	0.15	<MDA	0.89	<MDA	4.33	<MDA	0.99	<MDA	9.51
WL-215	0	0.77	0.72	<MDA	0.78	<MDA	4.39	<MDA	0.96	<MDA	17.02
WL-216	5	<MDA	2.36	<MDA	3.07	39.3	15.0	25.8	3.0	30.2	8.7
	25	<MDA	0.12	<MDA	0.61	<MDA	4.27	<MDA	0.63	<MDA	21.63
WL-217	5	<MDA	0.10	<MDA	0.53	<MDA	3.30	<MDA	0.82	<MDA	19.95
	10	<MDA	0.16	<MDA	0.60	<MDA	3.72	<MDA	0.71	<MDA	20.33
WL-218	0	0.41	0.23	<MDA	0.58	<MDA	3.59	<MDA	0.67	<MDA	14.84
	5	<MDA	0.13	<MDA	0.84	<MDA	5.12	<MDA	1.26	<MDA	28.83
	40	<MDA	0.13	<MDA	0.73	<MDA	4.21	<MDA	0.84	<MDA	21.50
WL-219	5	<MDA	0.11	<MDA	0.80	<MDA	5.53	<MDA	1.37	<MDA	26.48
	10	<MDA	0.41	<MDA	0.62	<MDA	3.55	<MDA	0.74	<MDA	16.44
WL-220	5	<MDA	0.11	<MDA	0.79	<MDA	4.36	<MDA	1.22	<MDA	21.37
	25	<MDA	0.18	<MDA	0.67	<MDA	4.37	<MDA	0.89	<MDA	24.86
WL-221	5	0.19	0.15	<MDA	0.64	<MDA	4.46	<MDA	1.06	<MDA	19.55
	35	<MDA	0.12	<MDA	0.79	<MDA	4.84	<MDA	1.13	<MDA	22.99
WL-222	0	0.69	0.56	<MDA	1.99	<MDA	11.4	<MDA	2.48	<MDA	44.46
	5	<MDA	0.12	<MDA	0.64	<MDA	4.19	0.69	0.68	<MDA	20.40
	30	<MDA	0.16	<MDA	1.22	<MDA	6.55	<MDA	1.40	<MDA	23.83
WL-223	5	<MDA	0.14	<MDA	0.75	<MDA	5.18	<MDA	1.33	<MDA	17.03
	22	<MDA	0.19	<MDA	0.60	<MDA	3.90	<MDA	0.81	<MDA	14.66
WL-224	5	<MDA	0.50	<MDA	0.71	<MDA	5.00	<MDA	1.05	<MDA	21.08
	35	<MDA	1.14	<MDA	0.69	<MDA	5.00	<MDA	0.88	<MDA	21.63
WL-225	5	<MDA	0.65	<MDA	0.75	<MDA	5.05	<MDA	0.91	<MDA	23.61
	35	<MDA	1.18	<MDA	0.93	<MDA	5.94	<MDA	1.31	<MDA	27.67

Table 2 - 7b

Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background (Mean+2 Std Dev)		1.15		NE		NE		NE		NE	
Reference Level Concentration *		6.15		5		5		5		5	
Surface Samples		16.15		15		15		15		15	
Subsurface Samples		16.15		15		15		15		15	
WL-226	10	0.39	0.36	<MDA	0.80	<MDA	3.14	<MDA	1.20	<MDA	21.54
	20	<MDA	1.19	<MDA	0.87	<MDA	7.51	<MDA	1.47	<MDA	28.91
WL-227	5	<MDA	0.63	<MDA	0.66	<MDA	3.96	<MDA	0.72	<MDA	16.05
	40	0.36	0.33	<MDA	0.54	<MDA	3.65	<MDA	0.58	<MDA	15.00
WL-228	5	<MDA	1.33	<MDA	0.51	<MDA	4.02	<MDA	0.68	<MDA	13.60
	15	<MDA	1.09	<MDA	0.73	<MDA	4.35	<MDA	1.11	<MDA	24.62
WL-229	5	<MDA	0.62	<MDA	0.64	<MDA	3.98	<MDA	0.82	<MDA	13.62
	20	<MDA	0.52	<MDA	0.64	<MDA	3.98	<MDA	0.91	<MDA	16.28
WL-230	5	0.48	0.38	<MDA	0.63	<MDA	4.86	<MDA	0.92	<MDA	17.88
	35	1.02	1.01	<MDA	0.69	<MDA	3.85	<MDA	0.97	<MDA	2.86
WL-231	0	0.91	0.38	<MDA	0.83	<MDA	4.76	<MDA	1.09	<MDA	18.17
	5	<MDA	3.37	<MDA	0.73	<MDA	4.56	1.86	0.72	<MDA	19.43
	10	0.68	0.54	<MDA	0.79	<MDA	4.83	0.76	0.71	<MDA	17.34
WL-233	27	<MDA	2.32	<MDA	1.02	<MDA	6.54	1.44	1.09	<MDA	20.81
	30	<MDA	2.30	<MDA	0.64	<MDA	4.72	<MDA	0.76	<MDA	16.06
WL-234	10	10.9	4.5	774	12	1050	64	952	12	891	39
	10 DUP (F)	9.55	0.62	97.6	7.9	460	40	397	8	380	24
	20	0.43	0.15	<MDA	0.86	<MDA	5.72	<MDA	1.34	<MDA	18.17
	20 DUP (F)	<MDA	1.23	<MDA	0.83	<MDA	5.24	<MDA	1.28	<MDA	18.16
WL-235	0	<MDA	0.49	<MDA	0.56	<MDA	3.69	<MDA	0.70	<MDA	17.28
	5	<MDA	0.92	<MDA	1.63	<MDA	8.84	<MDA	2.28	<MDA	29.14
	30	<MDA	0.30	<MDA	0.84	<MDA	4.88	<MDA	1.20	<MDA	15.87
WL-236	5	<MDA	0.75	<MDA	0.72	<MDA	4.94	<MDA	1.07	<MDA	14.39
	35	<MDA	1.17	<MDA	0.69	<MDA	3.94	<MDA	0.96	<MDA	14.14
WL-239	5	0.35	0.10	<MDA	0.33	<MDA	1.81	<MDA	0.36	<MDA	1.49
	25	<MDA	0.66	<MDA	0.23	<MDA	1.13	<MDA	0.38	<MDA	3.65
WL-241	5	0.23	0.23	<MDA	0.38	4.09	1.78	4.22	0.33	<MDA	5.35
	15	<MDA	0.20	<MDA	0.23	<MDA	1.15	<MDA	0.38	<MDA	3.12
WL-242	0	0.4	0.16	--	--	<MDA	5.12	<MDA	1.24	<MDA	31.72
	2	0.56	0.15	--	--	<MDA	9.23	<MDA	2.36	<MDA	52.37
WL-243	0	0.58	0.22	--	--	5.22	4.03	3.58	0.82	<MDA	25.10
WL-244	0	0.09	0.14	--	--	<MDA	4.57	0.81	0.73	<MDA	26.64

Table 2 - 7b
Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.15		NE		NE		NE		NE	
Reference Level Concentration *											
Surface Samples		6.15		5		5		5		5	
Subsurface Samples		16.15		15		15		15		15	
WL-245	0	0.13	0.28	—	—	<MDA	4.83	<MDA	1.32	<MDA	30.42
WL-246	0	0.1	0.27	—	—	<MDA	4.3	<MDA	0.91	<MDA	24.98
BACKGROUND SURFACE SOIL											
Barrow Pit - loess	0	0.41	0.28	<MDA	0.53	<MDA	3.36	<MDA	0.70	<MDA	16.53
Barrow Pit - shale	0	0.91	0.32	<MDA	0.56	<MDA	4.15	<MDA	0.70	<MDA	18.38
Farmer's Field	0	0.02	0.22	<MDA	0.77	<MDA	5.68	<MDA	1.34	<MDA	21.16
McLaren/Hart Shop	0	0.21	0.19	<MDA	0.73	<MDA	4.33	<MDA	0.89	<MDA	20.00

* - Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically if they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and samples have been conservatively selected for comparison of the data.

-- = Not reported

DUP (F) = Field duplicate

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

NE = Not Established

Bolded numbers indicate result reported above the minimum detectable activity.

TABLE 2 - 9
PERCHED WATER RADIOLOGICAL ANALYTICAL RESULTS - FILTERED GRAB SAMPLES
URANIUM-238 DECAY SERIES (picocuries per liter [pCi/L])
METHODS NAS-NS-3050, NAS-NS-3004, AND EPA 901.1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
AREA 1																	
WL-108	22	0.35	0.30	< MDA	287.8	< MDA	0.33	0.59	0.072	< MDA	38.2	< MDA	36.8	< MDA	38.2	< MDA	1100
AREA 2																	
WL-219	25	0.39	0.15	133 *	104	0.35	0.18	0.15	0.047	< MDA	28.9	< MDA	23.8	< MDA	28.9	< MDA	181
WL-220	30	< MDA	0.16	< MDA	148.5	0.19	0.17	1.72	0.15	< MDA	28.3	< MDA	23.1	< MDA	28.3	< MDA	139
WL-231	31	< MDA	0.62	< MDA	152	0.97	0.49	3.70	1.93	< MDA	27.7	< MDA	23.2	< MDA	27.7	< MDA	181
LEACHATE SEEP																	
Leachate Seep		0.54	0.18	--	--	0.94	0.28	0.85	0.4	0.83	0.83	--	--	--	--	--	--
Leachate Seep Dup (F)		0.75	0.24	--	--	0.98	0.24	<MDA	0.62	<MDA	0.69	--	--	--	--	--	--

-- = Not reported. In accordance with the Work Plan, the leachate seep was not analyzed by EPA 901.1.

DUP (L) = Laboratory duplicate

DUP (F) = Field duplicate

MDA = Minimum Detectable Activity

* = Analytical result is a false positive. The half-life of thorium-234 is 24 days and therefore thorium-234 should be in secular equilibrium with uranium-238. Review of parent and daughter products of thorium-234 indicate that secular equilibrium conditions exist and that the thorium-234 concentration should approximate 0.35 to 0.39 pCi/L.

Bolded numbers indicate result above the Minimum Detectable Activity.

TABLE 2 - 10
PERCHED WATER RADIOLOGICAL ANALYTICAL RESULTS - FILTERED GRAB SAMPLES
URANIUM-235 DECAY SERIES (picocuries per liter [pCi/L])
METHODS NAS-NS-3050 AND EPA 901.1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-235/236		Uranium-235		Protactinium-231		Actinium-227		Radium-223	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
AREA 1											
WL-108	22	< MDA	0.34	< MDA	100.3	< MDA	453	< MDA	91.6	< MDA	1157
AREA 2											
WL-219	25	< MDA	0.18	< MDA	53.4	< MDA	292	< MDA	61.8	< MDA	480.5
WL-220	30	< MDA	0.22	< MDA	49.3	< MDA	298	< MDA	55.3	< MDA	457.9
WL-231	31	< MDA	0.72	< MDA	53.2	< MDA	302	< MDA	60.6	< MDA	1327
LEACHATE SEEP											
Leachate Seep		< MDA	0.225	--	--	--	--	--	--	--	--
Leachate Seep Dup (F)		< MDA	0.300	--	--	--	--	--	--	--	--

-- = Not reported. In accordance with the Work Plan, the leachate seep was not analyzed by EPA 901.1.

DUP (F) = Field Duplicate

MDA = Minimum Detectable Activity.

Bolded numbers indicate result above the Minimum Detectable Activity.

TABLE 2 - 11
PERCHED WATER RADIOLOGICAL ANALYTICAL RESULTS - FILTERED GRAB SAMPLES
THORIUM-232 DECAY SERIES (picocuries per liter [pCi/L])
METHODS NAS-NS-3004 AND EPA 901.1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-228		Radium-224		Lead-212		Thallium-208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
AREA 1													
WL-108	22	< MDA	0.040	< MDA	54.0	< MDA	0.099	< MDA	274.4	< MDA	25.2	< MDA	18.0
AREA 2													
WL-219	25	0.042	0.024	< MDA	51.9	0.12	0.050	< MDA	194.7	< MDA	18.9	< MDA	13.2
WL-220	30	< MDA	0.09	< MDA	51.9	< MDA	0.16	< MDA	194.2	< MDA	17.2	< MDA	13.4
WL-231	31	< MDA	1.76	< MDA	52.4	< MDA	1.44	< MDA	175.7	< MDA	17.8	< MDA	14.3
LEACHATE SEEP													
Leachate Seep		< MDA	0.38	--	--	< MDA	0.60	--	--	--	--	--	--
Leachate Seep Dup (F)		< MDA	0.52	--	--	< MDA	0.63	--	--	--	--	--	--

-- = Not reported. In accordance with the Work Plan, the leachate seep was not analyzed by EPA 901.1.

DUP (F) = Field duplicate

MDA = Minimum Detectable Activity

Bolded numbers indicate result above the Minimum Detectable Activity.

Table 3 - 1
Background Soil Radiological Statistics
West Lake Landfill, Bridgeton, Missouri
(picocuries per gram [pCi/G])

Radionuclide	Detection Frequency ¹	Mean	Standard Deviation	Minimum Value	Maximum Value	Mean Plus 2 x Standard Deviations	Mean Plus 3 x Standard Deviations	Variance
Uranium-238 Decay Series								
Uranium-238	4/4	1.33	0.46	0.74	1.85	2.24	2.7	0.21
Thorium-234	2/4	1.57	0.59	1.15	1.99	2.76	3.35	0.35
Uranium-234	4/4	1.47	0.63	1.06	2.40	2.73	3.36	0.40
Thorium-230	4/4	1.51	0.47	0.92	2.03	2.45	2.91	0.22
Radium-226	4/4	1.06	0.12	0.95	1.19	1.30	1.41	0.01
Lead-214	4/4	1.01	0.06	0.92	1.07	1.13	1.19	0.004
Bismuth-214	2/4	1.09	0.26	0.90	1.27	1.61	1.87	0.07
Lead-210	3/4	2.48	0.64	1.88	3.16	3.77	4.41	0.41
Uranium-235 Decay Series								
Uranium-235/236	4/4	0.39	0.38	0.02	0.91	1.15	1.54	0.15
Uranium-235	--	--	--	--	--	--	--	--
Protactinium-231	--	--	--	--	--	--	--	--
Actinium-227	--	--	--	--	--	--	--	--
Radium-223	--	--	--	--	--	--	--	--
Thorium-232 Decay Series								
Thorium-232	4/4	0.90	0.33	0.52	1.26	1.55	1.87	0.11
Radium-228	2/4	1.65	0.36	1.39	1.90	2.37	2.73	0.13
Thorium-228	4/4	0.68	0.33	0.43	1.16	1.33	1.66	0.11
Radium-224	--	--	--	--	--	--	--	--
Lead-212	4/4	1.29	0.48	0.80	1.94	2.26	2.74	0.23
Thallium-208	4/4	0.44	0.14	0.32	0.63	0.71	0.84	0.02

¹Four background samples were analyzed. Samples without detections were not used to calculate background statistics.

-- = None of the four background samples detected radionuclides above the Minimum Detectable Activity (MDA).

Table 2-1
Gross Alpha (picocuries per liter [pCi/L]) - Unfiltered Grab Groundwater Samples
USEPA Method 900.0
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Gross Alpha	
	Result	MDA
Shallow Depth Wells		
S-51	< MDA	4.64
S-53	5.76	4.49
S-61	5.39	4.63
S-80	285	46
S-82	< MDA	13.3
S-84	< MDA	7.3
S-88	52.5	9.7
MW-F1S	< MDA	9.32
MW-101	< MDA	6.03
MW-102	< MDA	4.16
MW-102 DUP (F)	< MDA	4.7
MW-103	13.7	11.8
MW-104	< MDA	14.4
MW-106	< MDA	12
MW-107	< MDA	7.16
MW-F3	< MDA	10.7
Intermediate Depth Wells		
I-50	< MDA	7.47
I-62	< MDA	4.7
I-65	< MDA	2.06
I-66	< MDA	5.86
I-67	< MDA	7.55
I-68	< MDA	11.7
I-73	< MDA	7.24
Deep Depth Wells		
D-81	< MDA	2.79
D-81 DUP (F)	< MDA	2.83
D-83	< MDA	3.29
D-85	< MDA	11.2
D-87	< MDA	8.14
D-93	< MDA	5.4
MW-F1D	< MDA	8.5
Quarry Wells		
1201	< MDA	5.54
1204	7.78	4.46
1206	138	20

DUP (F) = Field duplicate

MDA = Minimum Detectable Activity

Bold numbers indicate results above the Minimum Detectable Activity

Unfiltered grab groundwater samples were collected using a bailer. No purging was performed prior to sample collection since the samples were collected solely for characterization of the groundwater prior to well development.

TABLE 2-2
Uranium-238 Decay Series (picocuries per liter [pCi/L]) - Filtered Groundwater Analytical Data For Three Existing Groundwater Wells That Exceeded
Metropolitan St. Louis Sewer District (MSD) Gross Alpha Criteria
Methods NAS-NS-3050, NAS-NS-3004, and USEPA 903.0
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Uranium-238		Uranium-234		Thorium-230		Radium-226	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-80	0.15	0.08	0.74	0.08	0.19	0.16	0.27	0.21
S-88	23.1	0.2	28.0	0.2	< MDA	0.32	0.50	0.41
S-88 DUP (L)	0.63	0.22	0.84	0.19	< MDA	0.38	< MDA	0.58
1206	0.27	0.05	0.42	0.05	0.35	0.12	1.43	0.26

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

S = Shallow Depth Monitoring Well

1206 = Quarry well

Bold numbers indicate result above the Minimum Detectable Activity

TABLE 2-3
Uranium-235 Decay Series (picocuries per liter [pCi/L]) - Filtered Groundwater Analytical Data For Three Existing Groundwater Wells That Exceeded
Metropolitan St. Louis Sewer District (MSD) Gross Alpha Criteria
Method NAS-NS-3050
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Uranium-235/236	
	Result	MDA
S-80	0.062	0.056
S-88	1.59	0.26
S-88 DUP (L)	0.12	0.11
1206	0.12	0.06

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

S= Shallow Depth Monitoring Well

1206 = Quarry well

Bold number indicate result above the Minimum Detectable Activity.

TABLE 2-4
Thorium-232 Decay Series (picocuries per liter [pCi/L]) - Filtered Groundwater Analytical Data For Three Existing Groundwater Wells That Exceeded
Metropolitan St. Louis Sewer District (MSD) Gross Alpha Criteria
Method NAS-NS-3004
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Thorium-232		Thorium-228	
	Result	MDA	Result	MDA
S-80	< MDA	0.139	< MDA	0.174
S-88	< MDA	0.318	< MDA	0.400
S-88 DUP (L)	< MDA	0.298	< MDA	0.524
1206	< MDA	0.123	< MDA	0.223

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

1206 = Quarry well

S = Shallow Depth Monitoring Well

TABLE 2-5
Gross Alpha (picocuries per liter [pCi/L]) - Filtered Groundwater Analytical Data For Three Existing Groundwater Wells That Exceeded
Metropolitan St. Louis Sewer District (MSD) Gross Alpha Criteria
USEPA Method 900.0
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Gross Alpha	
	Result	MDA
S-80	<MDA	10.1
S-88	10.3	9.0
S-88 DUP (L)	<MDA	11.1
1206	<MDA	9.34

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

S = Shallow Depth Monitoring Well

1206 = Quarry well

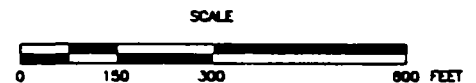
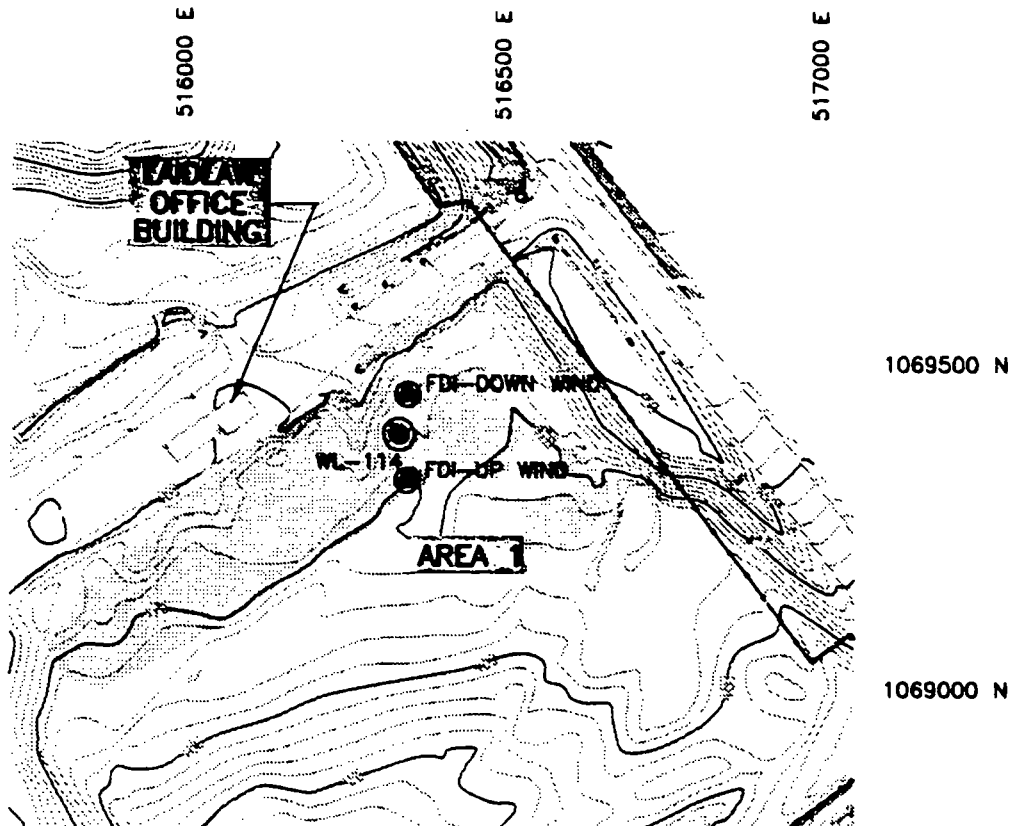
Bold numbers indicate result above the Minimum Detectable Activity.

DRAWING NUMBER 556-A033

DRAWN BY: KJP
DATE: 10/01/96
CHECKED BY:
APPROVED BY:

DESCR.
APPR. BY:

REVISIONS



LEGEND

WL-114 ● REMEDIAL INVESTIGATION SOIL BORING LOCATION

FD1 ● FUGITIVE DUST SAMPLING LOCATION

APPROXIMATE LIMITS OF ELEVATED GAMMA READINGS BASED ON OVERLAND GAMMA SURVEY AND DOWNHOLE GEOPHYSICAL LOGGING.

FUGITIVE DUST SAMPLING LOCATIONS
AREA 1
WEST LAKE LANDFILL
BRIDGETON, MISSOURI

PREPARED FOR
WEST LAKE
RESPONDENT GROUP



DATE: 07/26/96
SCALE: AS SHOWN

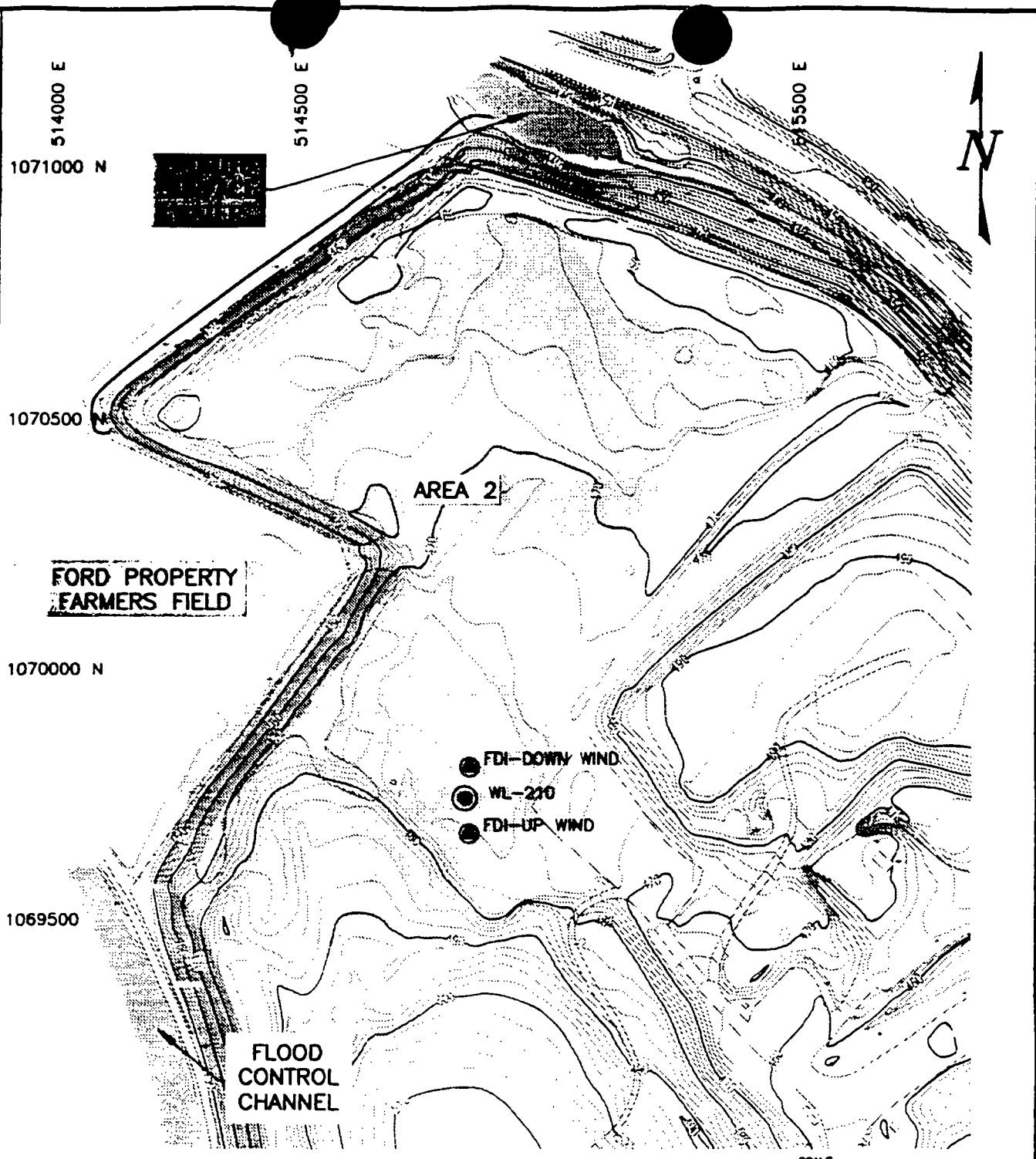
FIGURE 3-5

DRAWING NUMBER
556-A033



DRAWING NUMBER 556-A034

CHECKED BY
DATE 10/03/96
APPROVED BY

REVISIONS
DESCR. APPR. BY:



LEGEND

- WL-210  REMEDIAL INVESTIGATION SOIL BORING LOCATION
- FD1  FUGITIVE DUST SAMPLING LOCATION

APPROXIMATE LIMITS OF ELEVATED GAMMA READINGS BASED ON OVERLAND GAMMA SURVEY AND DOWNHOLE GEOPHYSICAL LOGGING

FUGATIVE DUST SAMPLING LOCATIONS
AREA 2
WEST LAKE LANDFILL
BRIDGETON, MISSOURI

PREPARED FOR
WEST LAKE
RESPONDENT GROUP



Table 3-7
Radiological Areas 1 and 2
Uranium-238 Decay Series (picocuries per liter [pCi/l]) - Fugitive Dust Analytical Results
Methods NAS-NS-3050, NAS-NS-3004, and USEPA Method 903.0
West Lake Landfill, Bridgeton, Missouri

Sample	Uranium-238			Uranium-234			Thorium-230			Radium-226		
	Result	MDA	Sigma Error	Result	MDA	Sigma Error	Result	MDA	Sigma Error	Result	MDA	Sigma Error
Area 1												
Upwind	< MDA	0.00164	NA	< MDA	0.00148	NA	0.00256	0.00042	0.00087	0.00043	0.00037	0.00027
Downwind	0.00071	0.00020	0.00038	0.00079	0.00024	0.00040	0.00071	0.00034	0.00033	< MDA	0.00049	NA
Area 2												
Upwind	0.00005	0.00004	0.00004	0.00007	0.00004	0.00005	0.00011	0.00006	0.00006	0.00011	0.00006	0.00005
Downwind	< MDA	0.00036	NA	< MDA	0.00049	NA	0.00055	0.00023	0.00027	< MDA	0.00035	NA

MDA = Minimum Detectable Activity

NA = Not applicable

Table 3-8
Radiological Areas 1 and 2
Uranium-235 Decay Series (picocuries per liter [pCi/l]) - Fugitive Dust Analytical Results
Method NAS-NS-3050
West Lake Landfill, Bridgeton, Missouri

Sample	Uranium-235/236		
	Result	MDA	Sigma Error
Area 1			
Upwind	< MDA	0.00237	NA
Downwind	< MDA	0.00030	NA
Area 2			
Upwind	< MDA	0.00007	NA
Downwind	< MDA	0.00068	NA

MDA = Minimum Detectable Activity

NA = Not applicable

Table 3-9
Radiological Areas 1 and 2
Thorium-232 Decay Series (picocuries per liter [pCi/l]) - Fugitive Dust Analytical Results
Method NAS-NS-3050
West Lake Landfill, Bridgeton, Missouri

Sample	Thorium-232			Radium-228			Thorium-228		
	Result	MDA	Sigma Error	Result	MDA	Sigma Error	Result	MDA	Sigma Error
Area 1									
Upwind	< MDA	0.00027	NA	< MDA	0.00113	NA	0.00270	0.00044	0.00090
Downwind	< MDA	0.00024	NA	< MDA	0.00097	NA	0.00191	0.00017	0.00058
Area 2									
Upwind	< MDA	0.00004	NA	< MDA	0.00017	NA	0.00037	0.00007	0.00013
Downwind	< MDA	0.00026	NA	0.00091	0.00090	0.00056	0.00154	0.00029	0.00049

MDA = Minimum Detectable Activity

NA= Not applicable

Table 2-1
Split Soil Analytical Results - Uranium-238 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050, HASL 300, and NAS-NS-3004
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-238				Thorium-234				Uranium-234				Thorium-230			
		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
AREA 1																	
WL-106	0	105	2	87	0.9	<MDA	18.75	180	11	105	3	110	0.9	9700	11.8	57000	480
WL-112	5	3.44	0.42	1.2	0.1	<MDA	2.55	<MDA	0.94	2.92	0.89	0.9	0.1	84.4	1.9	1500	
WL-117	10	2.90	0.16	1.3	0.1	1.44	0.59	<MDA	0.54	1.72	0.25	1.4	0.1	36.58	0.13	1400	
AREA 2																	
WL-213	0	1.53	0.42	0.9	0.1	2.05	1.51	<MDA	0.65	1.64	0.45	0.9	0.1	24.2	0.2	30	0.6
WL-214	5	0.81	0.09	0.6	0.1	1.14	1.08	0.43	0.35	1.09	0.12	0.8	0.1	44.4	0.21	2.9	0.8
WL-217	5	0.51	0.08	0.3	0.1	<MDA	1.80	0.20	0.20	0.45	0.08	0.5	0.1	0.96	0.13	1.1	0.1
WL-226	20	6.32	0.91	2.8	0.1	2.55	2.31	0.80	0.54	6.02	1.31	2.9	0.2	173	1.0	530	29
WL-234	10	138	5.0	100	0.4	24.5	19.9	140	21	128	5	83	0.8	57300	238	83000	28
WL-243	0	3.63	0.18	3.1	0.1	<MDA	1.94	2.5	2.2	3.99	0.24	3.3	0.1	265	0.22	1200	50
WL-244	0	1.35	0.09	1.2	0.1	<MDA	1.24	<MDA	0.49	0.88	0.12	1.2	0.1	20.8	0.71	63	0.5

* = Nuclear Regulatory Commissions's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

-- = Not reported

MDA = Minimum detectable activity

Bolded numbers indicate result reported above the minimum detectable activity.

Table 2-1
Split Soil Analytical Results - Uranium-238 Decay Series (picocuries per gram [pCi/g])
Methods NAS-NS-3050, HASL 300, and NAS-NS-3004
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Radium-226				Lead-214				Bismuth-214				Lead-210			
		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
AREA 1																	
WL-106	0	906	2	910	23	650	13	1100	33	908	2	1000	29	1040	23	860	22
WL-112	5	4.66	0.42	6.3	1.7	5.14	0.34	7.0	0.23	4.35	0.42	6.5	0.25	11.2	2.90	17	2.4
WL-117	10	3.15	0.07	4.0	1.4	2.92	0.08	3.9	0.23	3.22	0.07	3.2	0.23	5.82	0.87	5.1	1.1
AREA 2																	
WL-213	0	1.00	0.37	1.1	1.3	1.28	0.28	1.3	0.17	<MDA	0.70	1.2	0.17	2.36	2.13	2.3	1.6
WL-214	5	0.95	0.22	1.3	0.72	1.01	0.23	1.1	0.09	<MDA	0.62	1.0	0.11	<MDA	1.23	1.0	0.93
WL-217	5	0.60	0.31	0.64	0.62	0.53	0.25	0.50	0.11	<MDA	0.52	0.68	0.10	1.71	1.36	<MDA	0.40
WL-226	20	3.26	0.40	5.1	1.5	3.26	0.42	3.4	0.23	<MDA	1.21	3.4	0.23	5.93	2.62	2.4	1.1
WL-234	10	3060	4	1800	36	1100	25	2200	49	3060	4	2100	43	1300	24	500	16
WL-243	0	4.78	0.33	9.2	2.2	5.26	0.28	8.8	0.31	4.2	0.33	7.3	0.30	9.58	2.07	18	3.2
WL-244	0	1.54	0.33	2.6	1.4	1.58	0.21	1.7	0.22	1.31	0.33	1.4	0.21	2.02	1.48	1.4	0.97

* = Nuclear Regulatory Commissions's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

- = Not reported

MDA = Minimum detectable activity

Bolded numbers indicate result reported above the minimum detectable activity.

Table 2-2
Split Soil Analytical Results - Uranium-235 Decay Series (picocuries per gram [pCi/G])
Methods NAS-NS-3050 and HASL 300
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Uranium-235/236				Uranium-235				Protactinium-231				Actinium-227				Radium-223			
		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs ¹		Quanterra		Accu-Labs	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Area 1																					
WL-106	0	6.86	3.10	5.7	0.4	75.5	8.7	56	1.4	544	41	610	47	305	8	—	—	939	85	130	2.7
WL-112	5	< MDA	1.1	0.1	0.1	< MDA	0.99	0.39	0.10	< MDA	6.84	4.8	3.2	< MDA	1.59	—	—	< MDA	36.7	1.2	0.22
WL-117	10	< MDA	0.25	< MDA	0.1	0.30	0.27	0.25	0.09	< MDA	1.45	< MDA	3.2	0.79	0.23	—	—	5.48	4.32	0.28	0.12
Area 2																					
WL-213	0	0.45	0.38	0.1	0.1	< MDA	0.86	< MDA	0.08	< MDA	5.11	< MDA	4.4	< MDA	1.03	—	—	< MDA	18.4	< MDA	0.07
WL-214	5	0.81	0.14	0.1	0.1	< MDA	0.52	0.08	0.04	< MDA	3.52	< MDA	2.0	< MDA	0.55	—	—	< MDA	7.54	0.07	
WL-217	5	< MDA	0.10	< MDA	0.1	< MDA	0.53	0.04	0.04	< MDA	3.30	< MDA	2.3	< MDA	0.82	—	—	< MDA	19.95	< MDA	
WL-226	20	< MDA	1.19	< MDA	0.1	< MDA	0.87	0.32	0.09	< MDA	7.51	4.3	3.0	< MDA	1.47	—	—	< MDA	28.9	0.56	0.12
WL-234	10	10.9	4.5	24	0.4	774	12	110	2.2	1050	64	520	70	952	12	—	—	5270	232	88	2.4
WL-243	0	0.58	0.22	0.1	0.1	< MDA	0.75	0.57	0.14	5.22	4.03	6.5	4.4	3.58	0.82	—	—	< MDA	25.1	3.9	0.32
WL-244	0	< MDA	0.14	< MDA	0.1	< MDA	0.55	0.16	0.09	< MDA	4.57	< MDA	6.2	0.81	0.73	—	—	< MDA	26.6	0.16	0.11

* = Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides, they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

¹ = Accu-Labs actinium-227's energy and photon yield were too low to be seen on Accu-Labs gamma detectors.

-- = Not reported.

MDA = Minimum Detectable Activity

NE = Not established

Bolded numbers indicate result reported above the minimum detectable activity.

Table 2-3
Split Soil Analytical Results - Thorium-232 Decay Series (picocuries per gram [pCi/G])
Methods NAS-NS-3050, HASL 300, and NAS-NS-3004
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Thorium-232				Radium-228				Thorium-228			
		Quanterra		Accu-labs		Quanterra		Accu-labs ¹		Quanterra		Accu-labs	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
AREA 1													
WL-106	0	35.2	11.2	40	170	< MDA	5.84	–	–	< MDA	7.89	< MDA	240
WL-112	5	< MDA	1.56	< MDA	51	< MDA	1.20	–	–	1.55	1.48	< MDA	39
WL-117	10	1	0.12	< MDA	23	0.64	0.16	–	–	0.47	0.18	< MDA	23
AREA 2													
WL-213	0	1.11	0.20	< MDA	0.2	< MDA	0.90	–	–	0.79	0.22	< MDA	0.2
WL-214	5	0.41	0.14	0.5	0.2	< MDA	0.81	–	–	0.5	0.2	0.5	0.2
WL-217	5	< MDA	0.085	0.1	0.1	< MDA	0.81	–	–	< MDA	0.15	0.1	0.1
WL-226	20	< MDA	0.85	< MDA	21	< MDA	1.12	–	–	< MDA	0.99	< MDA	21
WL-234	10	< MDA	240	140	20	14.5	10.3	–	–	< MDA	196	< MDA	20
WL-243	0	6.73	0.15	< MDA	25	1.13	0.84	–	–	1.11	0.15	< MDA	35
WL-244	0	0.78	0.65	0.3	0.2	< MDA	1.05	–	–	< MDA	1.23	< MDA	0.2

* = Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

¹ = Radium-228 is not a gamma emitter so it does not show up on gamma spectrometry. However, radium-228 decays to actinium-228, which has three strong gamma peaks. The peak at 911 KeV is traditionally reported as the radium-228 concentration because of the equilibrium that exists between radium-228 and actinium-228.

– = Not reported

MDA = Minimum detectable activity

NE = Not established

Bolded numbers indicate result reported above the minimum detectable activity.

Table 2-3
Split Soil Analytical Results - Thorium-232 Decay Series (picocuries per gram [pCi/G])
Methods NAS-NS-3050, HASL 300, and NAS-NS-3004
West Lake Landfill, Bridgeton, Missouri

Boring	Depth (feet)	Radium-224				Lead-212				Bismuth-212				Thallium 208			
		Quanterra		Accu-labs ²		Quanterra		Accu-labs		Quanterra		Accu-labs		Quanterra		Accu-labs	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
AREA 1																	
WL-106	0	1760	24	–	–	< MDA	2.90	< MDA	5.2	< MDA	10.2	< MDA	32	< MDA	1.32	6.8	2.6
WL-112	5	< MDA	6.16	–	–	1.08	0.28	0.72	0.17	< MDA	2.02	1.8	1.7	0.43	0.21	0.42	
WL-117	10	6.48	0.71	–	–	0.58	0.06	0.57	0.14	< MDA	0.40	< MDA	3.0	0.16	0.04	0.27	
AREA 2																	
WL-213	0	< MDA	4.09	–	–	< MDA	0.37	0.38	0.12	< MDA	1.54	< MDA	2.6	< MDA	0.22	0.22	0.09
WL-214	5	< MDA	2.31	–	–	0.62	0.21	0.56	0.07	< MDA	1.34	0.74	0.74	0.24	0.17	0.22	0.05
WL-217	5	< MDA	2.83	–	–	< MDA	0.23	0.16	0.05	< MDA	1.26	< MDA	1.2	< MDA	0.19	0.08	0.05
WL-226	20	< MDA	3.32	–	–	< MDA	0.39	0.99	0.33	< MDA	2.05	< MDA	2.6	< MDA	0.25	0.14	0.11
WL-234	10	< MDA	87.5	–	–	10.8	3.2	82	8.5	< MDA	18.6	< MDA	49	3.09	2.26	7.9	3.8
WL-243	0	< MDA	4.33	–	–	1.04	0.22	0.79	0.21	< MDA	1.80	< MDA	4.1	0.46	0.15	0.28	0.16
WL-244	0	< MDA	2.24	–	–	0.86	0.2	0.84	0.12	< MDA	1.43	< MDA	1.5	0.23	0.17	0.42	0.11

* = Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

² = Radium-224 has its highest gamma emitter at 240 KeV, and has a photon yield of less than 4%. There are two strong peaks that usually interfere with the radium-224 peak: lead-212 at 241 KeV and lead-212 at 238 KeV. Both of these peaks have higher photon yields which prevents the visibility of radium-224.

- = Not reported

MDA = Minimum detectable activity

NE = Not established

Bolded numbers indicate result reported above the minimum detectable activity.

Table 3-1
Split Groundwater Analytical Results - Uranium-238 Decay Series (picocuries per liter [pCi/l])
Methods NAS-NS-3050, NAS-NS-3004, EPA 903.0 AND EPA 901.1
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Uranium-238								Thorium-234								Uranium-234							
	Unfiltered				Filtered				Unfiltered				Filtered				Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	< MDA	0.45	0.1	0.1	< MDA	2.88	0.1	0.1	< MDA	191	< MDA	112	< MDA	233	< MDA	66	< MDA	0.39	0.1	0.1	< MDA	3.91	0.1	0.1
MW-101	1.29	0.11	1.1	0.1	1.24	0.23	1.1	0.1	< MDA	140	< MDA	118	< MDA	93	< MDA	107	1.43	0.11	1.8	0.1	1.89	0.17	1.7	0.1
MW-107	0.15	0.11	< MDA	0.1	0.39	0.14	< MDA	0.1	< MDA	353	< MDA	170	< MDA	147	< MDA	108	0.23	0.13	0.2	0.1	0.53	0.13	0.2	0.1
MW-F3	< MDA	0.35	< MDA	0.1	1.24	0.23	< MDA	0.1	< MDA	234	< MDA	131	< MDA	192	< MDA	110	< MDA	0.22	< MDA	0.1	< MDA	0.61	< MDA	0.1

Monitoring Well	Thorium-230								Radium-226								Lead-214							
	Unfiltered				Filtered				Unfiltered				Filtered				Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	0.51	0.24	0.1	0.1	0.48	0.17	0.2	0.1	0.80	0.07	0.9	0.4	0.20	0.07	0.7	0.3	< MDA	21.3	< MDA	15	< MDA	21.5	< MDA	10
MW-101	0.19	0.09	0.5	0.1	0.38	0.13	< MDA	0.1	0.31	0.07	0.3	0.3	0.25	0.09	< MDA	0.3	< MDA	29.9	< MDA	17	< MDA	20.5	< MDA	15
MW-107	0.49	0.11	0.2	0.1	0.24	0.11	0.1	0.1	0.39	0.07	0.3	0.3	0.17	0.07	< MDA	0.3	< MDA	59.4	< MDA	18	< MDA	41.2	< MDA	15
MW-F3	0.21	0.09	0.2	0.1	0.59	0.08	0.2	0.1	1.35	0.07	0.6	0.3	1.34	0.06	0.8	0.3	< MDA	37.3	< MDA	18	< MDA	26	< MDA	15

Monitoring Well	Bismuth-214								Lead-210							
	Unfiltered				Filtered				Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	< MDA	24.1	< MDA	16	< MDA	27.6	< MDA	10	< MDA	292	< MDA	150	< MDA	1300	< MDA	76
MW-101	< MDA	37	< MDA	24	< MDA	33.9	< MDA	16	< MDA	154	< MDA	130	< MDA	139	< MDA	140
MW-107	< MDA	63.6	< MDA	24	82.1	27.1	< MDA	15	< MDA	3860	< MDA	130	< MDA	226	< MDA	150
MW-F3	< MDA	30.7	< MDA	25	< MDA	28.6	< MDA	13	< MDA	1300	< MDA	128	< MDA	304	< MDA	131

-- = Not reported

MDA = Minimum detectable activity

Bolded numbers indicate result reported above the minimum detectable activity

Table 3-2
Split Groundwater Analytical Results - Uranium-235 Decay Series (picocuries per liter [pCi/l])
Methods NAS-NS-3050, NAS-NS-3004 and EPA 901.1
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Uranium-235/236								Uranium-235							
	Unfiltered				Filtered				Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	< MDA	0.46	< MDA	0.1	< MDA	3.57	< MDA	0.1	< MDA	62.7	< MDA	14	< MDA	68.3	< MDA	8.6
MW-101	0.18	0.14	< MDA	0.1	< MDA	0.30	< MDA	0.1	< MDA	53.3	< MDA	13	< MDA	49.5	< MDA	13
MW-107	0.10	0.09	< MDA	0.1	< MDA	0.17	< MDA	0.1	< MDA	133	< MDA	14	< MDA	57.4	< MDA	14
MW-F3	< MDA	0.29	< MDA	0.1	< MDA	0.74	0.1	0.1	< MDA	70.7	< MDA	14	< MDA	62.8	12	12

Monitoring Well	Protactinium-231								Actinium-227							
	Unfiltered				Filtered				Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-labs ¹		Quanterra		Accu-Labs ¹	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	< MDA	291	< MDA	350	< MDA	338	< MDA	230	< MDA	54.6	--	--	< MDA	65.8	--	--
MW-101	< MDA	286	< MDA	420	< MDA	297	< MDA	330	< MDA	61.1	--	--	< MDA	55.8	--	--
MW-107	< MDA	640	< MDA	460	< MDA	355	< MDA	330	< MDA	125	--	--	< MDA	65.2	--	--
MW-F3	< MDA	314	< MDA	430	< MDA	275	< MDA	380	< MDA	68	--	--	< MDA	60.6	--	--

Monitoring Well	Radium-223							
	Unfiltered				Filtered			
	Quanterra		Accu-labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	< MDA	283	< MDA	14	< MDA	273	< MDA	8.3
MW-101	< MDA	300	< MDA	30	< MDA	245	< MDA	18
MW-107	< MDA	628	< MDA	31	< MDA	361	< MDA	14
MW-F3	< MDA	274	< MDA	30	< MDA	260	< MDA	16

¹ = Accu-Labs actinium-227's energy and photon yield were too low to be seen on Accu-Labs gamma detectors.

-- = Not reported

MDA = Minimum detectable activity

Bolded numbers indicate result reported above the minimum detectable activity

Table 3-3
Split Groundwater Analytical Results - Thorium-232 Decay Series (picocuries per liter [pCi/l])
Methods NAS-NS-3050, EPA 901.1, and NAS-NS-3004
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Thorium-232								Radium-228								Thorium-228							
	Unfiltered				Filtered				Unfiltered				Filtered				Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs		Quanterra		Accu-Labs ¹		Quanterra		Accu-Labs ¹		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	<MDA	0.22	<MDA	0.1	<MDA	0.14	<MDA	0.1	<MDA	42.9	--	--	<MDA	42.9	--	--	<MDA	0.18	<MDA	0.1	<MDA	0.31	<MDA	0.1
MW-101	<MDA	0.07	<MDA	0.1	<MDA	0.099	<MDA	0.1	<MDA	77.1	--	--	<MDA	43.7	--	--	<MDA	0.13	<MDA	0.1	<MDA	0.14	<MDA	0.1
MW-107	<MDA	0.11	0.1	0.1	<MDA	0.075	<MDA	0.1	<MDA	48.5	--	--	<MDA	50.3	--	--	0.15	0.14	0.1	0.1	<MDA	0.12	<MDA	0.1
MW-F3	<MDA	0.07	<MDA	0.1	0.08	0.08	<MDA	0.1	<MDA	41.8	--	--	<MDA	40.8	--	--	<MDA	0.097	0.1	0.1	<MDA	0.10	<MDA	0.1

Monitoring Well	Radium-224								Lead-212								Bismuth-212							
	Unfiltered				Filtered				Unfiltered				Filtered				Unfiltered				Filtered			
	Quanterra		Accu-Labs ²		Quanterra		Accu-Labs ²		Quanterra		Accu-Labs		Quanterra		Quanterra		Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	MDA	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	<MDA	193	--	--	<MDA	192	--	--	<MDA	16.5	<MDA	14	<MDA	18.4	83	83	<MDA	85	<MDA	200	<MDA	85	<MDA	130
MW-101	<MDA	189	--	--	<MDA	198	--	--	<MDA	17.0	<MDA	16	<MDA	16.8	13	13	<MDA	107	<MDA	190	<MDA	80	<MDA	190
MW-107	<MDA	351	--	--	<MDA	225	--	--	<MDA	35.5	<MDA	17	<MDA	18.5	13	13	<MDA	141	<MDA	200	<MDA	104	<MDA	190
MW-F3	<MDA	195	--	--	<MDA	179	--	--	<MDA	18.1	<MDA	17	<MDA	17.7	12	12	<MDA	85	<MDA	190	<MDA	84	<MDA	170

Monitoring Well	Thallium-208							
	Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	<MDA	11.3	<MDA	7.3	<MDA	11.4	<MDA	4.9
MW-101	<MDA	13	<MDA	8.2	<MDA	10.2	<MDA	7.5
MW-107	<MDA	24.8	<MDA	8.1	<MDA	14.1	<MDA	6.9
MW-F3	<MDA	12.4	<MDA	8.5	<MDA	11.9	<MDA	7.5

¹ = Radium-228 is not a gamma emitter so it does not show up on gamma spectrometry. However, radium-228 decays to actinium-228, which has three strong gamma peaks. The peak at 911 KeV is traditionally reported as the radium-228 concentration because of the equilibrium that exists between radium-228 and actinium-228.

² = Radium-224 has its highest gamma emitter at 240 KeV, and has a photon yield of less than 4%. There are two strong peaks that usually interfere with the radium-224 peak: lead-212 at 241 KeV and lead-212 at 238 KeV. Both of these peaks have higher photon yields which prevents the visibility of radium-224.

-- = Not reported. Result reported below the minimum

MDA = Minimum detectable activity

Bolded numbers indicate result reported above the minimum detectable activity.

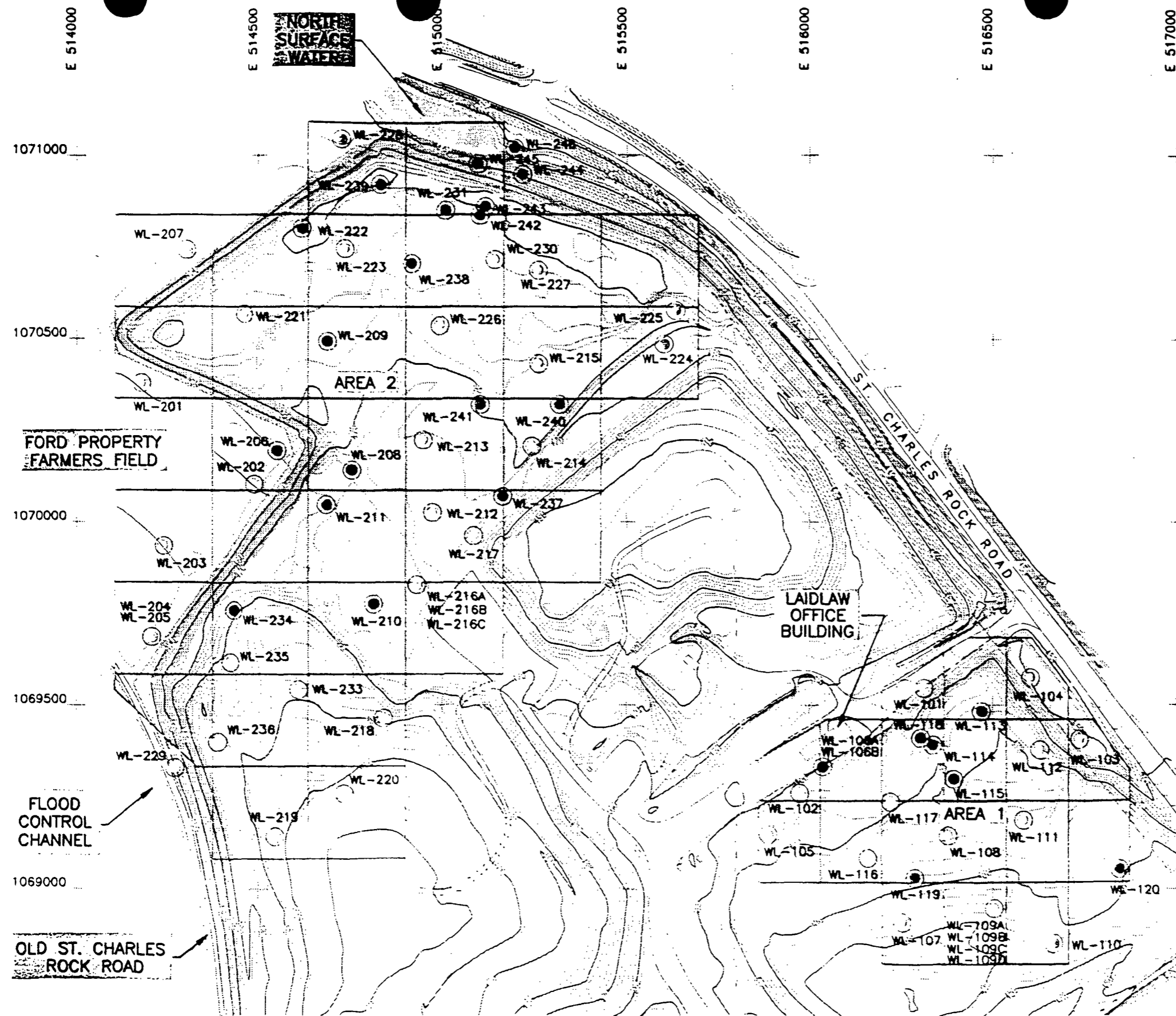
Table 3-4
Split Groundwater Analytical Results - Gross Alpha (picocuries per liter [pCi/l])
EPA Method 900.0
West Lake Landfill, Bridgeton, Missouri

Monitoring Well	Gross Alpha							
	Unfiltered				Filtered			
	Quanterra		Accu-Labs		Quanterra		Accu-Labs	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA
S-5	< MDA	53.2	< MDA	23	< MDA	32.4	< MDA	27
MW-101	3.60	1.51	4	2	4.42	1.78	< MDA	3
MW-107	5.45	2.65	< MDA	9	< MDA	2.9	7	6
MW-F3	9.92	2.33	8	3	12.5	2.3	7	3

-- = Not reported

MDA = Minimum detectable activity

Bolded numbers indicate results reported above the minimum detectable activity



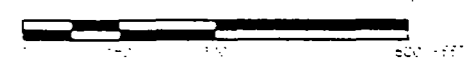
LEGEND

- WL-113 ● BIASED SOIL BORING LOCATION IDENTIFIED BASED ON REVIEW OF HISTORICAL AERIAL PHOTOGRAPHS
SOIL BORING NUMBER
- WL-118 ● BIASED SOIL BORING LOCATION IDENTIFIED BASED ON FINDINGS FROM PREVIOUS RADIOLOGICAL AND OVERLAND GAMMA SURVEY
SOIL BORING NUMBER
- WL-105 ● BIASED SOIL BORING LOCATION TO BE COMPLETED AS A GROUNDWATER MONITORING WELL
SOIL BORING NUMBER
- WL-116 ● RANDOM SOIL BORING LOCATION
SOIL BORING NUMBER
- WL-119 ● CONTINGENCY SOIL BORING LOCATION
SOIL BORING NUMBER

STRATIFIED RANDOM SAMPLING GRID

AREAL EXTENT OF OVERLAND GAMMA SURVEY

ELEVATION CONTOUR LINES
- FEET MSL

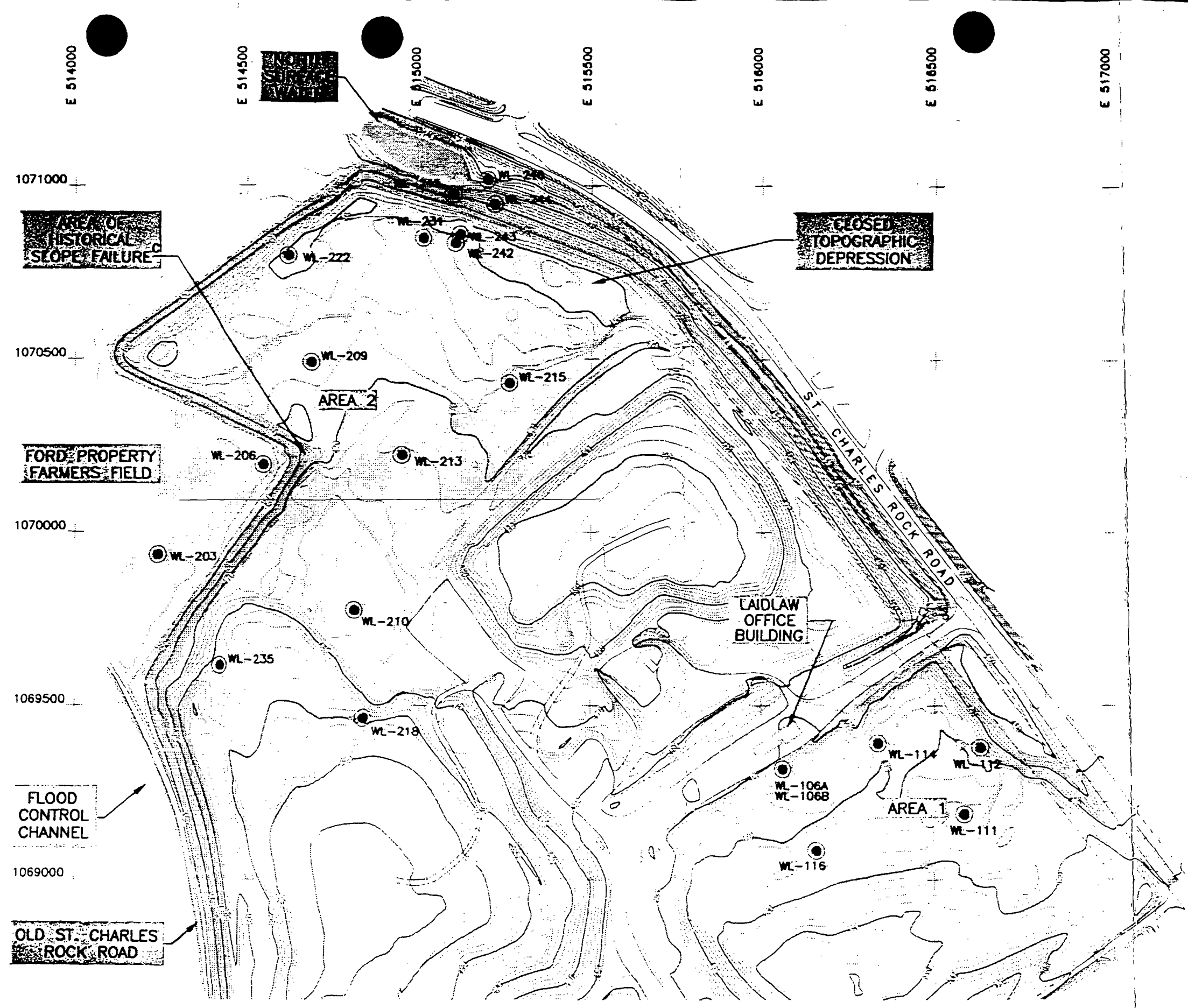


REMEDIAL INVESTIGATION
SOIL BORING LOCATION PLAN
RADIOLOGICAL AREAS 1 AND 2
WEST LAKE LANDFILL
BRIDGETON, MISSOURI

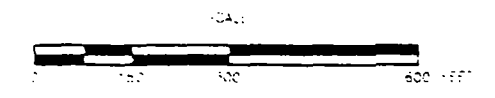
WEST LAKE
RESPONDENT GROUP



DRAWING NUMBER	556-8041	
	DRAWN BY:	KIP
CHECKED BY:	APPROVED BY:	
	DATE	07/30/98
DESCR.	APPR. BY:	
REVISIONS		



- LEGEND**
- WL-112 ● REMEDIAL INVESTIGATION SOIL BORING IN WHICH SURFACE SAMPLES WERE COLLECTED
SOIL BORING NUMBER
 - AREAL EXTENT OF OVERLAND GAMMA SURVEY
 - ELEVATION CONTOUR LINES
- FEET MSL



REMEDIAL INVESTIGATION
SURFACE SOIL SAMPLE LOCATION PLAN
RADIOLOGICAL AREAS 1 AND 2
WEST LAKE LANDFILL
BRIDGETON, MISSOURI

WEST LAKE
RESPONDENT GROUP



DEPTH TO WATER MEASUREMENTS

Well	Northing	Easting	Reference Point Elevation (Feet, MSL)	Depth to Water (Feet below TOC)																	
				1994		1995										1996					
				Nov. 22, 23, 28	December 29	January 30	March 3	March 30	April 28	May 26	June 30	July 28, Aug. 3*	Aug 31	Oct. 2	Oct. 31	Nov. 30	Jan. 5	April 2	July 5	Oct. 2	
Shallow Wells																					
S-1	1069685.83	514205.01	446.51	---	---	---	---	---	---	---	---	---	12.26	13.75	14.38	14.88	15.62	16.94	12.01	13.99	
S-5	1069155.84	515901.03	468.65	---	---	---	---	---	---	---	---	---	34.2	35.78	36.51	36.84	37.62	38.96	34.02	35.92	
S-8	1071044.35	514724.16	444.03	---	---	---	---	---	---	---	---	---	---	---	11.85	12.52	13.19	14.50	9.11	11.51	
S-10	1069827.87	514931.35	480.28	---	---	---	---	---	---	---	---	---	---	47.37	48.16	48.61	49.17	50.85	45.71	47.77	
S-51	1066161.31	514320.72	449.57	18.77	18.66	17.81	18.22	18.2	17.81	13.38	14.41	14.81	15.54	16.74	17.42	17.46	17.98	19.09	15.43	16.95	
S-53	1066871.02	514496.97	447.95	17.27	17.37	16.47	16.93	16.86	16.30	12.57	12.99	13.06	13.77	15.17	15.89	17.97	16.65	18.04	casing damaged	casing damaged	
S-61	1070159.98	514580.24	449.78	19.55	19.61	18.73	19.00	18.97	18.51	13.36	13.86	---	15.27	16.76	17.51	18.18	18.93	20.29	15.08	17.25	
S-75	1067250.41	514718.75	462.08	29.92	30.05	29.12	29.85	29.42	29.22	25.31	26.61	26.88	27.41	28.91	29.56	29.81	29.90	29.89	27.23	29.20	
S-80	1065191.77	513858.35	453.11	19.15	18.97	17.48	16.96	16.17	16.28	12.70	13.91	14.69	14.85	15.82	16.55	17.77	18.87	18.99	abandoned	abandoned	
S-82	1069311.99	514272.95	450.18	19.82	19.88	19.05	19.35	19.32	18.71	14.19	14.80	15.02	15.91	17.40	18.11	18.43	19.15	20.61	15.69	17.59	
S-84	1069633.39	516439.68	456.23	26.59	26.60	25.67	25.92	25.89	25.68	20.37	20.88	21.49	22.26	23.92	24.67	25.21	25.87	27.07	22.15	24.42	
S-88	1068398.39	515234.03	462.76	32.18	32.44	31.51	29.41	31.9	31.43	27.23	27.62	27.73	28.60	30.01	30.72	29.95	31.71	33.11	28.43	30.26	
MW-F1S	1068603.00	515865.35	461.35	31.11	31.00	30.26	30.42	30.42	30.05	25.74	26.05	26.32	27.06	28.52	29.26	29.58	30.31	31.69	26.99	28.86	
MW-101	1070830.48	514424.00	446.83	16.68	16.73	15.91	16.13	16.11	15.67	10.51	---	---	12.20	13.91	14.67	15.29	16.04	17.37	12.02	14.34	
MW-102	1070095.01	514532.93	448.18	17.95	18.00	17.18	17.41	17.38	16.91	11.64	12.31	12.81	13.70	15.32	16.06	18.58	17.16	18.67	13.47	15.64	
MW-103	1068628.37	514334.35	440.31	9.72	9.91	9.01	9.43	9.37	8.79	5.15	5.39	5.34	6.22	7.57	8.25	8.49	9.26	10.61	6.51	7.59	
MW-104	1067525.17	514339.01	440.96	10.33	10.43	9.48	9.98	9.93	9.33	5.72	6.11	6.13	6.95	8.27	8.95	9.06	9.71	11.11	6.78	8.39	
MW-106	1065955.75	513616.92	443.78	12.85	12.90	12.28	12.45	12.44	12.07	8.39	8.36	8.56*	9.27	casing damaged	NM	NM	NM	NM	NM	NM	
MW-107	1064670.74	513601.12	448.14	5.13	5.44	4.53	5.36	5.1	5.26	---	4.71	5.57	6.06	8.39	9.07	6.36	5.99	5.68	6.17	6.46	
MW-F3	1070489.80	515819.83	469.23	38.96	38.97	38.09	38.00	38.29	38.06	32.31	32.94	36.62	34.47	36.21	37.02	37.61	38.39	39.60	34.33	36.73	
Intermediate Depth Wells																					
I-2	1069698.26	514212.18	446.41	---	---	---	---	---	---	---	---	---	12.03	13.68	14.31	14.76	15.47	16.90	11.92	13.90	
I-4	1069148.42	515889.5	468.57	---	---	---	---	---	---	---	---	---	34.19	35.75	36.45	38.85	37.62	38.92	33.96	35.95	
I-7	1070743.05	514299.87	446.97	---	---	---	---	---	---	---	---	---	12.41	14.10	14.87	15.43	16.15	17.52	12.18	14.47	
I-9	1069329.26	514268.59	450.99	---	---	---	---	---	---	---	---	---	---	---	18.79	19.2	19.98	21.40	16.52	18.40	
I-11	1069819.16	514925.06	480.27	---	---	---	---	---	---	---	---	---	---	---	48.14	48.61	49.35	50.75	45.69	47.74	
I-50	1065190.32	513831.96	453.66	22.02	22.27	21.26	21.76	21.65	21.13	16.60	17.40	19.96	18.74	20.27	21	21.03	21.57	23.05	abandoned	abandoned	
I-62	1070938.26	514647.31	446.21	15.99	16.07	15.19	15.47	15.42	15.03	9.87	9.90	10.34*	11.55	13.02	13.78	14.71	15.36	16.71	11.34	13.71	
I-65	1070953.26	515333.39	441.82	11.6	11.70	10.83	11.00	11.03	10.66	5.25	7.35	8.12	7.04	8.81	9.66	10.3	11.06	12.31	6.87	9.36	
I-66	1070604.09	515851.01	441.91	11.61	11.66	10.78	11.00	10.95	10.61	5.18	5.56	6.26	7.11	8.83	9.69	10.32	11.04	12.28	6.98	9.45	
I-67	1070101.57	516244.09	441.90	11.54	11.57	10.63	10.93	10.97	10.65	5.06	5.65	6.31	7.11	8.81	9.61	10.23	10.87	12.16	7.03	9.39	
I-68	1069571.49	516686.36	450.50	20.16	20.10	19.05	19.44	19.45	19.24	13.94	14.52	16.16	15.91	17.52	18.29	18.8	19.45	20.64	15.74	18.03	
I-73	1067695.45	515570.09	461.39	31.46	31.68	30.80	31.12	31.9	30.69	26.04	27.15	27.25	27.97	29.39	30.12	30.31	31.00	32.35	28.87	29.52	
Deep Wells																					
D-3	1069136.26	515871.62	470.32	---	---	---	---	---	---	---	---	---	35.92	37.49	38.21	38.63	39.43	40.70	35.74	37.78	
D-6	1070194.31	514549.5	447.6	---	---	---	---	---	---	---	---	---	13.23	14.82	15.5	16.09	16.77	18.16	12.99	15.12	
D-12	1069836.29	514936.08	479.91	---	---	---	---	---	---	---	---	---	---	---	48	48.32	48.98	50.42	45.33	47.42	
D-13	1070485.74	515601.73	471.1	---	---	---	---	---	---	---	---	---	---	---	38.94	39.48	40.19	41.49	36.21	38.53	
D-14	1068947.16	516523.17	487.77	---	---	---	---	---	---	---	---	---	---	---	0	NM	58.62	59.69	56.21	57.79	
D-81	1067338.19	514463.68	451.00	20.3	20.39	19.56	19.95	19.95	19.29	15.62	16.08	16.14	16.91	18.24	18.95	19.04	19.71	21.11	16.78	18.37	
D-83	1070930.4	514633.64	448.48	18.29	18.40	17.50	17.82**	17.76	17.27	12.17	12.16	12.61*	13.88	15.70	16.41	17.01	17.77	19.01	13.72	16.02	
D-85	1069626.55	516430.42	457.13	26.82	26.77	25.87	26.12	26.13	25.89	20.60	21.11	21.71	22.48	24.13	24.87	25.42	26.11	27.39	22.39	24.61	
D-87	1069211.46	515404.82	463.05	32.81	32.82	31.96	32.19	32.2	31.81	27.10	27.57	27.86	28.69	30.28	30.96	31.36	32.11	33.54	28.60	30.58	
D-93	1069317.89	514269.69	448.62	19.66	19.74	18.92	19.22	19.18	18.58	14.02	14.67	14.83	15.79	17.25	18.01	18.34	19.06	20.51	15.59	17.50	
MW-F1D	1068608.68	515860.04	461.63	31.42	31.31	30.51	30.70	30.78	30.41	26.04	26.34	26.61	27.36	28.86	29.6	29.88	30.62	32.02	27.29	29.19	
Staff Gages																					
1	1071100.73	514883.10	438.57	---	---	---	---	---	---	---	4.2	3.25	2.35	---	1.5	Drv	Drv	Drv	2.30	Drv	
2	1071107.71	514878.03	438.84	---	---	---	---	---	---	---	3.95	3.05	2.1	---	1.25	Drv	Drv	Drv	2.25	Drv	
3	1071249.28	514645.19	440.73	---	---	---	---	---	---	---	1.98	1.05	<0.5	---	3.2	Drv	Drv	Drv	Drv	Drv	
4	1071253.42	514635.63	441.05	---	---	---	---	---	---	---	1.7	0.80	<0.5	---	2.95	Drv	Drv	Drv	Drv	Drv	
5	1070745.51	515414.94	460.94	---	---	---	---	---	---	---	---	---	---	---	Drv	Drv	Drv	Drv	Drv	Drv	
6	1069471.76	514096.61	437.28	---	---	---	---	---	---	---	2.18	2.64	1.55	---	0.25	0.7	Drv	Drv	1.75	0.80	
7	1069480.90	514091.25	437.01	---	---	---	---	---	---	---	2.45	2.95	1.8	0.30	0	1	Drv	Drv	2.00		

NM = Not Measured

Water Level Elevation Data

Well	Northing	Easting	Reference Point Elevation (Feet, MSL)	Groundwater Elevation (Feet, MSL)																	
				1994				1995								1996					
				Nov. 22, 23, 28	December 29	January 30	March 3	March 30	April 28	May 26	June 30	July 28, Aug. 3*	Aug 31	Oct. 2	Oct. 31	Nov. 30	Jan. 5	April 2	July 5	Oct. 2	
Shallow Wells																					
S-1	1069685.83	514205.01	446.51	---	---	---	---	---	---	---	---	---	434.25	432.76	432.13	431.63	430.89	429.57	514193.00	432.52	
S-5	1069155.84	515901.03	468.65	---	---	---	---	---	---	---	---	---	434.45	432.87	432.14	431.81	431.03	429.69	515867.01	432.73	
S-8	1071044.35	514724.16	444.03	---	---	---	---	---	---	---	---	---	---	---	432.18	431.51	430.84	429.53	514715.05	432.52	
S-10	1069827.87	514931.35	480.28	---	---	---	---	---	---	---	---	---	---	---	432.91	432.12	431.67	431.11	429.43	514885.64	432.51
S-51	1066161.31	514320.72	449.57	430.8	430.91	431.76	431.35	431.37	431.76	436.19	435.16	434.76	434.03	432.83	432.15	432.11	431.59	430.48	514305.29	432.62	
S-53	1066871.02	514496.97	447.95	430.68	430.58	431.48	431.02	431.09	431.65	435.38	434.96	434.89	434.18	432.78	432.06	429.98	431.30	429.91	casing damaged	casing damaged	
S-61	1070159.98	514580.24	449.78	430.23	430.17	431.05	430.78	430.81	431.27	436.42	435.92	---	434.51	433.02	432.27	431.6	430.85	429.49	514565.16	432.53	
S-75	1067250.41	514718.75	462.08	432.16	432.03	432.96	432.23	432.66	432.86	436.77	435.47	435.20	434.67	433.17	432.52	432.27	432.18	432.19	514691.52	432.88	
S-80	1065191.77	513858.35	453.11	433.96	434.14	435.63	436.15	436.94	436.83	440.41	439.20	438.42	438.26	437.29	436.56	435.34	434.24	434.12	abandoned	abandoned	
S-82	1069311.99	514272.95	450.18	430.36	430.30	431.13	430.83	430.86	431.47	435.99	435.38	435.16	434.27	432.78	432.07	431.75	431.03	429.57	514257.26	432.59	
S-84	1069633.39	516439.68	456.23	429.64	429.63	430.56	430.31	430.34	430.55	435.86	435.35	434.74	433.97	432.31	431.56	431.02	430.36	429.16	516417.53	431.81	
S-88	1068398.39	515234.03	462.76	430.58	430.32	431.25	433.35	430.86	431.33	435.53	435.14	435.03	434.16	432.75	432.04	432.81	431.05	429.65	515205.60	432.50	
MW-F1S	1068603.00	515865.35	461.35	430.24	430.35	431.09	430.93	430.93	431.30	435.61	435.30	435.03	434.29	432.83	432.09	431.77	431.04	429.66	515838.36	432.49	
MW-101	1070830.48	514424.00	446.83	430.15	430.10	430.92	430.70	430.72	431.16	436.32	---	---	434.63	432.92	432.16	431.54	430.79	429.46	514411.98	432.49	
MW-102	1070095.01	514532.93	448.18	430.23	430.18	431.00	430.77	430.8	431.27	436.54	435.87	435.37	434.48	432.86	432.12	429.6	431.02	429.51	514519.46	432.54	
MW-103	1068628.37	514334.35	440.31	430.59	430.40	431.30	430.88	430.94	431.52	435.16	434.92	434.97	434.09	432.74	432.06	431.82	431.05	429.7	514327.84	432.72	
MW-104	1067525.17	514339.01	440.96	430.63	430.53	431.48	430.98	431.03	431.63	435.24	434.85	434.83	434.01	432.69	432.01	431.9	431.25	429.85	514332.23	432.57	
MW-106	1065955.75	513616.92	443.78	430.93	430.88	431.50	431.33	431.34	431.71	435.39	435.42	435.22	434.51	---	NM	NM	NM	NM	NM	NM	
MW-107	1064670.74	513601.12	448.14	443.01	442.70	443.61	442.78	443.04	442.88	---	443.43	442.57	442.08	439.75	439.07	441.78	442.15	442.46	513594.95	441.68	
MW-F3	1070489.80	515819.83	469.23	430.27	430.26	431.14	431.23	430.94	431.17	436.92	436.29	432.61	434.76	433.02	432.21	431.62	430.84	429.63	515785.50	432.50	
Intermediate Depth Wells																					
I-2	1069698.26	514212.18	446.41	---	---	---	---	---	---	---	---	---	434.38	432.73	432.1	431.65	430.94	429.51	514200.26	432.51	
I-4	1069148.42	515889.5	468.57	---	---	---	---	---	---	---	---	---	434.38	432.82	432.12	429.72	430.95	429.65	515855.54	432.62	
I-7	1070743.05	514299.87	446.97	---	---	---	---	---	---	---	---	---	434.56	432.87	432.1	431.54	430.82	429.45	514287.69	432.50	
I-9	1069329.26	514268.59	450.99	---	---	---	---	---	---	---	---	---	---	---	432.2	431.79	431.01	429.59	514252.07	432.59	
I-11	1069819.16	514925.06	480.27	---	---	---	---	---	---	---	---	---	---	---	432.13	431.66	430.92	429.52	514879.37	432.53	
I-50	1065190.32	513831.96	453.66	431.64	431.39	432.40	431.90	432.01	432.53	437.06	436.26	433.70	434.92	433.39	432.66	432.63	432.09	430.61	abandoned	abandoned	
I-62	1070938.26	514647.31	446.21	430.22	430.14	431.02	430.74	430.79	431.18	436.34	436.31	435.87	434.66	433.19	432.43	431.5	430.85	429.5	514635.97	432.50	
I-65	1070953.26	515333.39	441.82	430.22	430.12	430.99	430.82	430.79	431.16	436.57	434.47	433.70	434.78	433.01	432.16	431.52	430.76	429.51	515326.52	432.46	
I-66	1070604.09	515851.01	441.91	430.3	430.25	431.13	430.91	430.96	431.30	436.73	436.35	435.65	434.80	433.08	432.22	431.59	430.87	429.63	515844.03	432.46	
I-67	1070101.57	516244.09	441.90	430.36	430.33	431.27	430.97	430.93	431.25	436.84	436.25	435.59	434.79	433.09	432.29	431.67	431.03	429.74	516237.06	432.51	
I-68	1069571.49	516686.36	450.50	430.34	430.40	431.45	431.06	431.05	431.26	436.56	435.98	434.34	434.59	432.98	432.21	431.7	431.05	429.86	516670.62	432.47	
I-73	1067695.45	515570.09	461.39	429.93	429.71	430.59	430.27	429.49	430.70	435.35	434.24	434.14	433.42	432.00	431.27	431.08	430.39	429.04	515541.22	431.87	
Deep Wells																					
D-3	1069136.26	515871.62	470.32	---	---	---	---	---	---	---	---	---	434.40	432.83	432.11	431.69	430.89	429.62	515835.88	432.54	
D-6	1070194.31	514549.5	447.6	---	---	---	---	---	---	---	---	---	434.37	432.78	432.1	431.51	430.83	429.44	514536.51	432.48	
D-12	1069836.29	514936.08	479.91	---	---	---	---	---	---	---	---	---	---	---	431.91	431.59	430.93	429.49	514890.75	432.49	
D-13	1070485.74	515601.73	471.1	---	---	---	---	---	---	---	---	---	---	---	432.16	431.62	430.91	429.61	515565.52	432.57	
D-14	1068947.16	516523.17	487.77	---	---	---	---	---	---	---	---	---	---	---	Drv	NM	429.15	428.08	516466.96	429.98	
D-81	1067338.19	514463.68	451.00	430.7	430.61	431.44	431.05	431.05	431.71	435.38	434.92	434.86	434.09	432.76	432.05	431.96	431.29	429.89	514446.90	432.63	
D-83	1070930.4	514633.64	448.48	430.19	430.08	430.98	430.66	430.72	431.21	436.31	436.32	435.87	434.60	432.78	432.07	431.47	430.71	429.47	514619.92	432.46	
D-85	1069626.55	516430.42	457.13	430.31	430.36	431.26	431.01	431	431.24	436.53	436.02	435.42	434.65	433.00	432.26	431.71	431.02	429.74	516408.03	432.52	
D-87	1069211.46	515404.82	463.05	430.24	430.23	431.09	430.86	430.85	431.24	435.95	435.48	435.19	434.36	432.77	432.09	431.69	430.94	429.51	515376.22	432.47	
D-93	106931																				

NM = Not Measured

		Gross Alpha			Thorium-232			Radium-228			Thorium-228			Lead-212		
		Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma
SW-1 UNFILTERED	15-May-97	2.24	0.76	0.73	0.11	0.044	0.06	<50.1	50.1		0.085	0.055	0.051	<18.6	18.6	
SW-2 UNFILTERED	15-May-97	1.91	0.4	0.49	0.029	0.037	0.028	<68.8	68.8		0.041	0.048	0.035	<20.8	20.8	
SW1 PRESERVED	15-May-97	1.24	0.83	0.66	0.006	0.082	0.033	<63.9	63.9		0.025	0.084	0.041	<23.3	23.3	
SW2 PRESERVED	15-May-97	3.68	1.89	1.59	0.033	0.079	0.047	<54.8	54.8		0.028	0.12	0.056	<23	23	
SW2 PRESERVED (dup)	15-May-97	5.1	1.58	1.49	<0.008	0.094	0.011	<43.8	43.8		0.048	0.17	0.056	<23.3	23.3	
SW3	15-May-97	2.48	0.74	0.76	0.056	0.051	0.043	<53.1	53.1		0.058	0.08	0.051	<19.9	19.9	
D-12	15-May-97	1.15	1.9	0.69	0.02	0.38	0.12	<46.2	46.2		<0.23	0.71	0.11	<21.7	21.7	
D-12 TOTAL	15-May-97	2.27	3.58	1.68	0.042	0.17	0.08	<46.8	46.8		0.04	0.29	0.12	<21.3	21.3	
D-12(dup)	15-May-97	<0.35	2.15	0.51	0	0.13	0	<54.9	54.9		0.05	0.73	0.29	<19.2	19.2	
D-3	15-May-97	0.16	1.12	0.14	0	0.033	0	<50.3	50.3		0.1	0.1	0.08	<20.2	20.2	
D-3 TOTAL	15-May-97	2.14	2.5	1.5	<0.02	0.11	0.013	<64.4	64.4		0.11	0.15	0.09	<19.1	19.1	
D-6	15-May-97	1.54	1.63	1.01	0.012	0.15	0.058	<64.4	64.4		0.16	0.16	0.11	<17.5	17.5	
D-6 TOTAL	15-May-97	8.79	3.93	3.38	0.067	0.05	0.048	<31.2	31.2		0.098	0.11	0.069	<10.1	10.1	
D-93	15-May-97	<0.17	0.68	0.44	0.08	0.63	0.26	<60	60		0.03	0.69	0.26	<19.4	19.4	
D-93 TOTAL	15-May-97	0.94	3.99	1.91	0.062	0.065	0.052	<27.6	27.6		0.071	0.083	0.059	<9.9	9.9	
I-2	15-May-97	1.52	1.06	0.66	0.009	0.11	0.039	<60.2	60.2		0.032	0.13	0.062	<21.2	21.2	
I-2 TOTAL	15-May-97	<1.6	4.52	7.86	0.026	0.033	0.028	<55	55		0.043	0.072	0.043	<19.6	19.6	
I-2-DUP	15-May-97	0.99	1.22	0.6	0.011	0.09	0.035	<37.4	37.4		0.098	0.13	0.083	<22.8	22.8	
I-2-DUP TOTAL	15-May-97	1.23	0.81	0.63	0.015	0.048	0.025	<51	51		0.038	0.06	0.038	<23.4	23.4	
I-4	15-May-97	<0.98	1.26	2.67	0.009	0.067	0.026	<61	61		0.039	0.17	0.076	<17.8	17.8	
I-4 TOTAL	15-May-97	<0.44	2.68	0.91	0.032	0.062	0.042	<53.7	53.7		0.063	0.1	0.065	<23.8	23.8	
S-82	15-May-97	1.24	3.31	1.59	<0.004	0.067	0.005	<48.3	48.3		<0.015	0.18	0.062	<24.3	24.3	
S-82 TOTAL	15-May-97	1.35	0.74	0.6	0.085	0.038	0.071	<61.3	61.3		0.048	0.14	0.073	<18.1	18.1	
S-82 TOTAL(dup)	15-May-97	1.23	0.6	0.51	0.093	0.16	0.093	<57	57		0.023	0.16	0.067	<20.3	20.3	

		Bismuth 212			Thallium-208		
		Result	MDA	Sigma	Result	MDA	Sigma
SW-1 UNFILTERED	15-May-97	<161	161		<16.1	16.1	
SW-2 UNFILTERED	15-May-97	<282	282		<16	16	
SW1 PRESERVED	15-May-97	<212	212		<14	14	
SW2 PRESERVED	15-May-97	161	139	95	<13	13	
SW2 PRESERVED (dup)	15-May-97	<202	202		<15.3	15.3	
SW3	15-May-97	<218	218		<14.4	14.4	
D-12	15-May-97	<198	198		<13.2	13.2	
D-12 TOTAL	15-May-97	<206	206		<15.3	15.3	
D-12(dup)	15-May-97	<236	236		<14.9	14.9	
D-3	15-May-97	<173	173		<14.3	14.3	
D-3 TOTAL	15-May-97	<174	174		<13.9	13.9	
D-6	15-May-97	<191	191		<14	14	
D-6 TOTAL	15-May-97	<108	108		<7.91	7.91	
D-93	15-May-97	<222	222		<13.4	13.4	
D-93 TOTAL	15-May-97	<99.6	99.6		<7.53	7.53	
I-2	15-May-97	<196	196		<15.4	15.4	
I-2 TOTAL	15-May-97	<210	210		<14.8	14.8	
I-2-DUP	15-May-97	<189	189		<16.4	16.4	
I-2-DUP TOTAL	15-May-97	<220	220		<14.2	14.2	
I-4	15-May-97	<188	188		<11.8	11.8	
I-4 TOTAL	15-May-97	<160	160		<14.4	14.4	
S-82	15-May-97	<173	173		<14.9	14.9	
S-82 TOTAL	15-May-97	<213	213		<12.2	12.2	
S-82 TOTAL(dup)	15-May-97	<209	209		<15.1	15.1	

All units are pCi/g

May 1997 Groundwater Uranium-238 Series Data

Well/Surface Sample	Date	Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-214		
		Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma
SW-1 UNFILTERED	15-May-97	0.91	0.08	0.26	1.28	0.08	0.33	0.22	0.05	0.08	<253	253		<24.2	24.2	
SW-2 UNFILTERED	15-May-97	0.81	0.08	0.23	1.08	0.05	0.28	0.22	0.04	0.08	<298	298		<34.6	34.6	
SW1 PRESERVED	15-May-97	1.28	0.12	0.4	1.44	0.12	0.43	0.16	0.07	0.08	<280	280		<28.3	28.3	
SW2 PRESERVED	15-May-97	0.63	0.15	0.27	1.32	0.17	0.42	0.25	0.079	0.12	<315	315		<33.8	33.8	
SW2 PRESERVED (dup)	15-May-97	1.06	0.12	0.34	1.39	0.16	0.41	0.51	0.12	0.2	<258	258		<26.5	26.5	
SW3	15-May-97	0.99	0.12	0.3	1.29	0.13	0.36	0.36	0.062	0.12	<296	296		<26.4	26.4	
D-12	15-May-97	0.23	0.13	0.14	0.22	0.15	0.14	0.14	0.38	0.21	<303	303		<24	24	
D-12 TOTAL	15-May-97	0.14	0.1	0.08	0.23	0.12	0.11	0.2	0.19	0.15	<344	344		<25	25	
D-12(dup)	15-May-97	0.02	0.15	0.064	0.23	0.093	0.13	0.16	0.42	0.23	<244	244		<28.8	28.8	
D-3	15-May-97	0.16	0.059	0.08	0.3	0.059	0.12	0.054	0.077	0.056	429	192	408	<26.5	26.5	
D-3 TOTAL	15-May-97	0.11	0.058	0.07	0.25	0.048	0.1	0.028	0.13	0.057	<218	218		<26.8	26.8	
D-6	15-May-97	0.063	0.096	0.072	0.13	0.12	0.1	0.13	0.14	0.1	<247	247		<27.2	27.2	
D-6 TOTAL	15-May-97	1.13	0.37	0.49	2.46	0.29	0.76	0.52	0.07	0.15	<139	139		<13.6	13.6	
D-93	15-May-97	0.047	0.19	0.091	0.19	0.1	0.1	2.69	0.63	1.18	<276	276		<23.3	23.3	
D-93 TOTAL	15-May-97	2.12	0.31	0.7	2.87	0.29	0.84	0.26	0.083	0.11	<136	136		<14.3	14.3	
I-2	15-May-97	0.14	0.15	0.1	0.26	0.13	0.12	0.38	0.16	0.17	<269	269		<28.1	28.1	
I-2 TOTAL	15-May-97	0.27	0.18	0.16	0.45	0.22	0.21	0.29	0.043	0.1	<308	308		<24.7	24.7	
I-2-DUP	15-May-97	0.2	0.14	0.11	0.38	0.1	0.14	0.13	0.097	0.09	<270	270		<30.4	30.4	
I-2-DUP TOTAL	15-May-97	0.31	0.16	0.18	1.13	0.2	0.38	0.14	0.055	0.07	<299	299		<29.8	29.8	
I-4	15-May-97	0.04	0.085	0.05	0.11	0.086	0.07	0.005	0.081	0.027	<254	254		<26.3	26.3	
I-4 TOTAL	15-May-97	0.078	0.13	0.077	0.1	0.09	0.07	0.18	0.084	0.1	<269	269		<27.8	27.8	
S-82	15-May-97	1.13	0.022	0.27	1.5	0.074	0.33	0.18	0.067	0.1	<356	356		<24.9	24.9	
S-82 TOTAL	15-May-97	1.48	0.27	0.49	1.73	0.25	0.54	0.55	0.068	0.2	<286	286		<28.2	28.2	
S-82 TOTAL(dup)	15-May-97	1.37	0.27	0.48	1.21	0.3	0.45	0.73	0.17	0.25	<291	291		<30.1	30.1	

		Bismuth 214			Lead-210		
		Result	MDA	Sigma	Result	MDA	Sigma
SW-1 UNFILTERED	15-May-97	<33.2	33.2		<221	221	
SW-2 UNFILTERED	15-May-97	<34.6	34.6		<208	208	
SW1 PRESERVED	15-May-97	<32	32		<150000	150000	
SW2 PRESERVED	15-May-97	<28.4	28.4		<414	414	
SW2 PRESERVED (dup)	15-May-97	<34.6	34.6		<259	259	
SW3	15-May-97	<32.9	32.9		<224	224	
D-12	15-May-97	<30.6	30.6		<355	355	
D-12 TOTAL	15-May-97	<28.4	28.4		<411	411	
D-12(dup)	15-May-97	<40.7	40.7		<212	212	
D-3	15-May-97	<30.2	30.2		<203	203	
D-3 TOTAL	15-May-97	<29.3	29.3		<234	234	
D-6	15-May-97	<27	27		204	158	198
D-6 TOTAL	15-May-97	<16.2	16.2		<100	100	
D-93	15-May-97	<30.9	30.9		<190	190	
D-93 TOTAL	15-May-97	<16.2	16.2		<108	108	
I-2	15-May-97	<34.1	34.1		<230	230	
I-2 TOTAL	15-May-97	<34.4	34.4		<240	240	
I-2-DUP	15-May-97	<32.5	32.5		<77000	77000	
I-2-DUP TOTAL	15-May-97	<26.5	26.5		<171000	171000	
I-4	15-May-97	<31.8	31.8		<176	176	
I-4 TOTAL	15-May-97	<35.1	35.1		<71400	71400	
S-82	15-May-97	<31	31		<402	402	
S-82 TOTAL	15-May-97	<35.5	35.5		<199	199	
S-82 TOTAL(dup)	15-May-97	<31.4	31.4		<222	222	

All units are pCi/l

May 1997 Groundwater Uranium-235 Series Data

		Uranium-235/236			Protactinium-231			Actinium-227			Radium-223		
		Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma
SW-1 UNFILTERED	15-May-97	0.07	0.1	0.07	<309	309		<63.3	63.3		<112	112	
SW-2 UNFILTERED	15-May-97	0.12	0.08	0.08	<276	276		<73.2	73.2		<121	121	
SW1 PRESERVED	15-May-97	0.25	0.14	0.17	<422	422		<79.4	79.4		<416	416	
SW2 PRESERVED	15-May-97	0.14	0.08	0.13	<358	358		<81	81		<194	194	
SW2 PRESERVED (dup)	15-May-97	0.06	0.16	0.09	<336	336		<73.1	73.1		<107	107	
SW3	15-May-97	0.13	0.12	0.11	<351	351		<69.4	69.4		<125	125	
D-12	15-May-97	0.08	0.18	0.1	<317	317		<67.9	67.9		<225	225	
D-12 TOTAL	15-May-97	0.003	0.16	0.066	<345	345		<77.8	77.8		<246	246	
D-12(dup)	15-May-97	0.1	0.16	0.11	<338	338		<62.8	62.8		<186	186	
D-3	15-May-97	0.047	0.073	0.051	<381	381		<56.3	56.3		<135	135	
D-3 TOTAL	15-May-97	0.087	0.029	0.063	<340	340		<60	60		<135	135	
D-6	15-May-97	0.049	0.14	0.078	<358	358		<68.3	68.3		<127	127	
D-6 TOTAL	15-May-97	0.67	0.43	0.41	<185	185		<32.4	32.4		<68.9	68.9	
D-93	15-May-97	0.041	0.14	0.07	<297	297		<60.3	60.3		<134	134	
D-93 TOTAL	15-May-97	1.15	0.31	0.53	<164	164		<33.5	33.5		<72	72	
I-2	15-May-97	<0.004	0.15	0.056	<351	351		<78.3	78.3		<156	156	
I-2 TOTAL	15-May-97	0.049	0.14	0.078	<404	404		<69.6	69.6		<170	170	
I-2-DUP	15-May-97	0.029	0.15	0.07	<399	399		<84.3	84.3		<479	479	
I-2-DUP TOTAL	15-May-97	0.08	0.17	0.11	<433	433		<83.8	83.8		<524	524	
I-4	15-May-97	0.019	0.065	0.035	<315	315		<50.8	50.8		<122	122	
I-4 TOTAL	15-May-97	0.017	0.12	0.052	<456	456		<82.3	82.3		<466	466	
S-82	15-May-97	0.1	0.028	0.07	<390	390		<72.8	72.8		<232	232	
S-82 TOTAL	15-May-97	0.18	0.25	0.18	<344	344		<56.1	56.1		<120	120	
S-82 TOTAL(dup)	15-May-97	0.12	0.24	0.15	<382	382		<71.1	71.1		<172	172	

All units are pCi/l

May 1997 Soils Thorium 232 Se Data

Location	Sample Date	Thorium-232			Radium-228			Thorium-228			Lead-212			Bismuth 212			Thallium-208		
		Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma
B1 S	15-May-97	0.87	0.09	0.23	<2.14	2.14		1.2	0.17	0.29	1.1	0.46	0.4	<4.94	4.94		<0.53	0.53	
B2 S	15-May-97	1.02	0.1	0.26	<1.69	1.69		1.11	0.08	0.28	1.19	0.26	0.37	<5.64	5.64		0.59	0.17	0.23
B3 S	15-May-97	1.06	0.05	0.27	<1.82	1.82		0.88	0.12	0.24	0.81	0.49	0.45	<5.84	5.84		<0.51	0.51	
B4 S	15-May-97	1.16	0.07	0.3	<1.79	1.79		1.17	0.12	0.31	<0.95	0.95		<5.48	5.48		<0.53	0.53	
DUP	15-May-97	0.52	0.06	0.17	<1.94	1.94		0.65	0.07	0.2	<0.69	0.69		<7.17	7.17		<0.52	0.52	
FP1 0-3	12-May-97	1.1	0.22	0.38	<2.13	2.13		1.15	0.21	0.39	<0.97	0.97		<5.69	5.69		<0.51	0.51	
FP1 0-3(dup)	12-May-97	1.06	0.05	0.27	<2.06	2.06		1.22	0.08	0.3	0.92	0.47	0.42	<5.36	5.36		<0.53	0.53	
FP1 12-24	12-May-97	0.84	0.05	0.23	<2.29	2.29		0.93	0.09	0.25	0.8	0.36	0.38	<5.82	5.82		<0.5	0.5	
FP2 0-3	12-May-97	1.08	0.14	0.29	<2.85	2.85		1.2	0.09	0.31	1.24	0.44	0.53	<6.71	6.71		<0.62	0.62	
FP2 12-24	12-May-97	1.13	0.1	0.29	<2.61	2.61		1.17	0.18	0.3	1.41	0.51	0.5	<6.62	6.62		<0.59	0.59	
FP3 0-3	12-May-97	0.85	0.1	0.23	<2.05	2.05		0.9	0.08	0.24	1.13	0.45	0.43	<4.13	4.13		<0.51	0.51	
FP3 12-24	12-May-97	0.91	0.05	0.24	<1.66	1.66		0.78	0.11	0.22	0.88	0.29	0.28	<4.24	4.24		0.44	0.17	0.19
FP4 0-3	12-May-97	1.16	0.06	0.3	<2.6	2.6		1.53	0.12	0.37	1.15	0.38	0.68	<4.36	4.36		<0.61	0.61	
FP4 12-24	12-May-97	1.28	0.05	0.32	<1.73	1.73		1.42	0.16	0.35	1.23	0.55	0.6	<7.11	7.11		<0.58	0.58	
FP5 0-3	12-May-97	1.38	0.08	0.34	<0.94	0.94		1.46	0.12	0.36	1.14	0.28	0.35	<2.96	2.96		0.46	0.18	0.2
FP5 12-24	12-May-97	1.2	0.02	0.3	<1.96	1.96		1.25	0.12	0.31	0.93	0.56	0.36	<6.68	6.68		<0.48	0.48	
FP6 0-3	12-May-97	0.95	0.06	0.24	<1.56	1.56		0.97	0.1	0.25	1.26	0.37	0.37	<6.74	6.74		<0.48	0.48	
FP6 12-24	12-May-97	1.2	0.05	0.28	<1.95	1.95		0.91	0.05	0.23	<0.76	0.76		<6.09	6.09		<0.49	0.49	
FP7 0-3	12-May-97	1.14	0.05	0.27	<1.78	1.78		1.08	0.09	0.26	1.59	0.32	0.38	<5.54	5.54		<0.39	0.39	
FP7 12-24	12-May-97	0.1	0.03	0.23	<2.13	2.13		1.18	0.07	0.27	<0.72	0.72		<6.19	6.19		<0.52	0.52	
FP8 0-3	12-May-97	1.57	0.09	0.35	<1.68	1.68		1.37	0.09	0.31	0.98	0.46	0.4	<5.67	5.67		<0.57	0.57	
FP8-1-2	04-Jun-97	1.29	0.067	0.29	<2.92	2.92		1.37	0.1	0.3	1.86	0.41	0.51	<7.84	7.84		<0.56	0.56	
SED 1	15-May-97	0.47	0.05	0.15	<1.44	1.44		0.56	0.09	0.17	0.7	0.63	0.44	<5.34	5.34		<0.42	0.42	
SED 1(dup)	15-May-97	0.57	0.1	0.18	<2.41	2.41		0.65	0.1	0.19	<0.84	0.84		<5.23	5.23		<0.5	0.5	
SED 2	15-May-97	0.24	0.05	0.1	<0.85	0.85		0.2	0.07	0.09	<0.38	0.38		<3.22	3.22		<0.28	0.28	
SED 3	15-May-97	0.92	0.06	0.26	<1.68	1.68		1.17	0.11	0.31	<0.91	0.91		<5.89	5.89		<0.57	0.57	
SED 4	15-May-97	0.84	0.13	0.24	<1.83	1.83		0.74	0.09	0.22	0.84	0.4	0.33	<4.4	4.4		<0.21	0.21	
WEIR 1	15-May-97	0.33	0.05	0.12	<1.12	1.12		0.3	0.14	0.13	0.4	0.32	0.37	<2.89	2.89		<0.23	0.23	
WEIR 2	15-May-97	1.83	0.08	0.43	<1.84	1.84		1.08	0.13	0.29	0.95	0.43	0.39	<5.85	5.85		0.4	0.29	0.36
WEIR 3	15-May-97	0.79	0.02	0.22	<1.7	1.7		0.87	0.12	0.24	0.82	0.33	0.35	<7.13	7.13		<0.49	0.49	
WEIR 4	15-May-97	1.29	0.07	0.33	<1.84	1.84		1.37	0.08	0.34	1.47	0.39	0.51	<5.18	5.18		<0.53	0.53	
WEIR 5	15-May-97	4.82	0.28	1.66	<1.62	1.62		0.56	0.91	0.57	<1.19	1.19		<5.57	5.57		<0.46	0.46	
WEIR 6	15-May-97	2.09	0.1	0.47	<1.86	1.86		1.29	0.1	0.32	<0.94	0.94		<6.29	6.29		0.49	0.31	0.38
WEIR 7	15-May-97	0.94	0.25	0.46	<2.02	2.02		0.57	0.62	0.41	0.78	0.44	0.35	<6.05	6.05		<0.55	0.55	
WEIR 8	15-May-97	0.86	0.07	0.24	<1.87	1.87		0.72	0.08	0.21	<0.69	0.69		<4.83	4.83		<0.49	0.49	
WEIR 9	15-May-97	22.6	3.66	8	<2.09	2.09		2.08	6.71	3.23	<0.98	0.98		<6.32	6.32		<0.49	0.49	

All units are pCi/g

Location	Sample Date	Uranium-235/236			Uranium-235			Protactinium-231			Actinium-227			Radium-223		
		Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma
B1 S	15-May-97	0.06	0.19	0.1				<9.05	9.05		<2.78	2.78		<10.8	10.8	
B2 S	15-May-97	0.09	0.12	0.08				<6.32	6.32		<1.06	1.06		<2.74	2.74	
B3 S	15-May-97	0.2	0.13	0.13				<8.02	8.02		<1.76	1.76		<3.6	3.6	
B4 S	15-May-97	0.14	0.07	0.08				<10.4	10.4		<2.69	2.69		<11.2	11.2	
DUP	15-May-97	0.093	0.048	0.06				<8.79	8.79		<2.83	2.83		<13	13	
FP1 0-3	12-May-97	0.15	0.07	0.08				<6.1	6.1		<2.81	2.81		<13.2	13.2	
FP1 0-3(dup)	12-May-97	0.15	0.05	0.07				<8.11	8.11		<2.12	2.12		<4.5	4.5	
FP1 12-24	12-May-97	0.13	0.05	0.07				<6.26	6.26		<1.38	1.38		<2.98	2.98	
FP2 0-3	12-May-97	0.14	0.1	0.08				<8.77	8.77		<1.69	1.69		<4.05	4.05	
FP2 12-24	12-May-97	0.26	0.08	0.11				<8.86	8.86		<1.96	1.96		<4.76	4.76	
FP3 0-3	12-May-97	0.063	0.057	0.051				<8.34	8.34		<2.23	2.23		<4.81	4.81	
FP3 12-24	12-May-97	0.38	0.05	0.13				<4.24	4.24		<0.95	0.95		<2.42	2.42	
FP4 0-3	12-May-97	0.11	0.06	0.07				<6.8	6.8		<1.48	1.48		<3.88	3.88	
FP4 12-24	12-May-97	0.095	0.061	0.064				<8.97	8.97		<2.21	2.21		<4.84	4.84	
FP5 0-3	12-May-97	0.062	0.05	0.047				<5.21	5.21		<1.39	1.39		<7.38	7.38	
FP5 12-24	12-May-97	0.22	0.09	0.13				<7.37	7.37		<1.95	1.95		<4.66	4.66	
FP6 0-3	12-May-97	0.07	0.1	0.06				<6.66	6.66		<1.52	1.52		<3.42	3.42	
FP6 12-24	12-May-97	0.093	0.025	0.061				<5.87	5.87		<1.36	1.36		<3.25	3.25	
FP7 0-3	12-May-97	0.15	0.04	0.1				<7.08	7.08		<1.42	1.42		<3.22	3.22	
FP7 12-24	12-May-97	0.05	0.14	0.08				<6.77	6.77		<1.71	1.71		<3.98	3.98	
FP8 0-3	12-May-97	0.11	0.08	0.09				<6.96	6.96		<1.33	1.33		<3.96	3.96	
FP8-1-2	04-Jun-97	0.07	0.32	0.18				<8.08	8.08		<1.37	1.37		<0.49	0.49	
SED 1	15-May-97	1.29	0.11	0.32				<8.85	8.85		<2.23	2.23		<11	11	
SED 1(dup)	15-May-97	0.14	0.03	0.08				<10.7	10.7		<2.18	2.18		<4.6	4.6	
SED 2	15-May-97	0.068	0.062	0.055				<5.84	5.84		<1.16	1.16		<2.56	2.56	
SED 3	15-May-97	0.14	0.09	0.08				<8.8	8.8		<2.69	2.69		<11.2	11.2	
SED 4	15-May-97	0.07	0.15	0.09				<5.9	5.9		<1.27	1.27		<2.46	2.46	
WEIR 1	15-May-97	0.12	0.06	0.08				<6.29	6.29		<1.4	1.4		<2.42	2.42	
WEIR 2	15-May-97	0.19	0.1	0.11	2.27		1.39	<10.7	10.7		<3.02	3.02		3.65	0.84	0.78
WEIR 3	15-May-97	0.18	0.1	0.11				<5.49	5.49		<1.37	1.37		<3.7	3.7	
WEIR 4	15-May-97	0.09	0.11	0.08				<7.99	7.99		<1.83	1.83		<3.45	3.45	
WEIR 5	15-May-97	0.65	0.07	0.19				<19	19		<4.51	4.51		<26.2	26.2	
WEIR 6	15-May-97	0.25	0.07	0.12				<9.41	9.41		<2.74	2.74		<6.51	6.51	
WEIR 7	15-May-97	0.17	0.15	0.11				<9.99	9.99		<2.36	2.36		<6.59	6.59	
WEIR 8	15-May-97	0.2	0.07	0.1				<6.65	6.65		<1.59	1.59		<2.98	2.98	
WEIR 9	15-May-97	0.28	0.07	0.12	6.05	2.34	3.14	<16.3	16.3		5.72	2.49	2.41	4.4	1.19	1.14

All units are pCi/g

Location	Sample Date	Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-214			Bismuth 214			Lead-210		
		Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma	Result	MDA	Sigma
B1 S	15-May-97	0.94	0.17	0.27	0.78	0.13	0.24	1.57	0.1	0.36	<7.28	7.28		1.62	0.59	0.56	<1.28	1.28		<1910	1910	
B2 S	15-May-97	0.87	0.09	0.25	0.94	0.1	0.26	1.93	0.12	0.43	<5.44	5.44		1.08	0.44	0.5	<1	1		<3.66	3.66	
B3 S	15-May-97	2.33	0.12	0.54	2.94	0.07	0.65	1.45	0.07	0.34	<5.98	5.98		1.16	0.38	0.44	<0.97	0.97		<3.45	3.45	
B4 S	15-May-97	1.02	0.06	0.26	1.5	0.06	0.34	2.16	0.07	0.49	<5.22	5.22		<1.02	1.02		<1.05	1.05		950	771	1650
DUP	15-May-97	1.17	0.06	0.26	1.04	0.06	0.24	3.18	0.07	0.66	<8.22	8.22		<1.26	1.26		<1.55	1.55		<2640	2640	
FP1 0-3	12-May-97	0.81	0.09	0.21	0.73	0.08	0.19	12.8	0.2	2.8	<7.23	7.23		<0.98	0.98		<1.25	1.25		<1460	1460	
FP1 0-3(dup)	12-May-97	0.8	0.06	0.19	0.84	0.07	0.2	1.39	0.06	0.33	7.19	4.63	3.98	1.68	0.47	0.55	<1	1		<4.47	4.47	
FP1 12-24	12-May-97	0.75	0.06	0.19	0.69	0.04	0.18	1.16	0.06	0.29	<4.94	4.94		0.73	0.36	0.41	<1.14	1.14		<3.83	3.83	
FP2 0-3	12-May-97	1.17	0.09	0.26	1.08	0.07	0.24	2.92	0.1	0.63	<6.28	6.28		0.75	0.55	0.65	<1.27	1.27		4.96	3.15	4.05
FP2 12-24	12-May-97	0.94	0.1	0.24	0.78	0.1	0.21	1.24	0.12	0.31	7.99	4.93	4.85	<1.22	1.22		<1.29	1.29		<3.66	3.66	
FP3 0-3	12-May-97	0.79	0.05	0.2	0.69	0.07	0.18	1.26	0.11	0.31	<6.23	6.23		<0.89	0.89		<1.11	1.11		<4.3	4.3	
FP3 12-24	12-May-97	2.62	0.07	0.51	1.94	0.07	0.4	1.26	0.07	0.31	<4.24	4.24		1.03	0.36	0.4	<1.01	1.01		<3.19	3.19	
FP4 0-3	12-May-97	0.96	0.05	0.23	1.01	0.04	0.23	2.61	0.07	0.57	9.06	3.62	3.81	1	0.62	0.69	<1.2	1.2		4.35	2.81	3.5
FP4 12-24	12-May-97	0.84	0.06	0.21	0.71	0.06	0.19	2.2	0.07	0.49	<5.58	5.58		1.13	0.55	0.51	<1.28	1.28		3.97	3.97	3.27
FP5 0-3	12-May-97	1.05	0.04	0.23	0.84	0.05	0.2	28.6	0.08	5.2	4.08	2.99	3.1	1.54	0.29	0.42	<0.65	0.65		<811	811	
FP5 12-24	12-May-97	1.2	0.09	0.33	1.11	0.08	0.32	5.31	0.09	1.03	<6.04	6.04		1.07	0.56	0.44	<1.05	1.05		4.62	3.34	2.82
FP6 0-3	12-May-97	0.91	0.06	0.21	0.73	0.07	0.18	1.2	0.06	0.29	<5.59	5.59		0.82	0.49	0.42	<1.25	1.25		<2.78	2.78	
FP6 12-24	12-May-97	1.07	0.05	0.25	0.86	0.04	0.21	1.8	0.05	0.39	<3.25	3.25		<0.92	0.92		<0.96	0.96		<3.73	3.73	
FP7 0-3	12-May-97	0.82	0.07	0.25	0.88	0.06	0.26	2.08	0.07	0.43	4.72	3.49	2.89	0.85	0.44	0.45	<0.89	0.89		<3.22	3.22	
FP7 12-24	12-May-97	0.71	0.13	0.26	0.65	0.15	0.25	1.51	0.03	0.32	<6.63	6.63		1.12	0.46	0.5	<0.95	0.95		<3.98	3.98	
FP8 0-3	12-May-97	0.81	0.08	0.25	0.95	0.06	0.28	21.8	0.09	3.8	<5.22	5.22		1.49	0.43	0.54	<1.15	1.15		4.96	2.27	2.62
FP8-1-2	04-Jun-97	1.3	0.24	0.42	0.93	0.21	0.34	2.04	0.082	0.42	<5.78	5.78		1.59	0.56	0.52	<1.37	1.37		3.81	3.18	3.22
SED 1	15-May-97	3.14	0.12	0.62	16.3	0.09	2.8	2.71	0.05	0.56	<5.08	5.08		<1.06	1.06		<1.07	1.07		<2000	2000	
SED 1(dup)	15-May-97	0.97	0.02	0.24	0.95	0.08	0.24	2.93	0.08	0.6	6.74	6.86	4.99	1.72	0.59	0.57	<1.46	1.46		4.84	4.16	3.84
SED 2	15-May-97	0.71	0.04	0.19	0.58	0.06	0.16	1.7	0.05	0.37	<3.9	3.9		<0.6	0.6		<0.72	0.72		<2.22	2.22	
SED 3	15-May-97	0.78	0.11	0.19	0.81	0.06	0.19	3.06	0.07	0.66	<6.17	6.17		<1.12	1.12		<1.11	1.11		<1980	1980	
SED 4	15-May-97	0.53	0.16	0.18	0.69	0.14	0.21	4.04	0.1	0.83	5.4	2.98	2.82	0.83	0.41	0.41	<1.08	1.08		<3.72	3.72	
WEIR 1	15-May-97	0.61	0.08	0.18	0.76	0.08	0.21	3.02	0.06	0.62	4.77	3.6	3.96	<0.67	0.67		<0.82	0.82		<2.54	2.54	
WEIR 2	15-May-97	2.15	0.07	0.47	1.77	0.09	0.4	215	0.08	39	<7.43	7.43		5.84	0.56	1.03	<1.88	1.88		10.6	3.6	3.4
WEIR 3	15-May-97	1.14	0.08	0.3	1.23	0.11	0.32	11.6	0.09	2.1	5.59	3.7	3.68	1.1	0.47	0.48	<1.15	1.15		<2.56	2.56	
WEIR 4	15-May-97	0.62	0.09	0.18	0.7	0.09	0.2	1.46	0.07	0.36	<5.43	5.43		0.73	0.52	0.37	<0.88	0.88		<3.85	3.85	
WEIR 5	15-May-97	5	0.08	0.9	5.92	0.1	1.06	770	0.91	139	<13.9	13.9		<2.89	2.89		9.6	0.72	1.74	<1880	1880	
WEIR 6	15-May-97	2.65	0.08	0.56	2.81	0.06	0.59	68.8	0.1	12.3	9.17	5.41	4.57	2.66	0.62	0.77	<1.67	1.67		5.98	4.42	3.93
WEIR 7	15-May-97	1.43	0.13	0.33	1.44	0.11	0.33	154	0.25	27	6.57	5.4	4.2	2.09	0.65	0.73	<1.78	1.78		16.3	3.6	5.2
WEIR 8	15-May-97	0.79	0.1	0.21	0.82	0.09	0.21	3.51	0.09	0.73	<6.13	6.13		<1.05	1.05		<1.37	1.37		<4.21	4.21	
WEIR 9	15-May-97	2.5	0.06	0.5	4.06	0.1	0.75	1160	4.98	212	<13.7	13.7		21.8	0.79	2.8	18.5	0.93	2.8	31.7	7.5	9.3

All units are pCi/g

TABLE 2 - 0a
SOIL ANALYTICAL RESULTS - URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g]) -
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration																	
Surface Samples		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Subsurface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
AREA 1																	
WL-101	5	0.88	0.11	< MDA	1.95	1.54	0.13	2.18	0.07	1.04	0.33	1.02	0.27	1.22	0.33	< MDA	1.83
	20	1.63	0.13	1.47	1.36	1.47	0.17	1.63	0.23	0.91	0.35	0.92	0.26	0.73	0.35	1.31	1.30
WL-102	5	0.88	0.12	< MDA	1.16	1.06	0.11	4.18	0.23	1.17	0.26	1.56	0.26	< MDA	0.63	1.49	1.32
	15	1.34	0.10	< MDA	1.47	1.24	0.11	1.68	0.3	0.98	0.35	1.14	0.31	< MDA	0.64	< MDA	2.30
WL-103	5	1.60	0.16	< MDA	1.95	1.95	0.20	1.42	0.22	1.17	0.34	1.13	0.33	1.23	0.34	1.82	1.75
	10	1.12	0.14	< MDA	4.02	1.41	0.19	7.52	0.16	0.81	0.53	0.71	0.47	< MDA	0.99	< MDA	43.8
WL-104	5	0.70	0.14	< MDA	0.98	1.19	0.15	3.08	0.21	0.78	0.50	0.92	0.31	0.68	0.30	< MDA	1.17
	20	0.32	0.11	< MDA	1.16	0.52	0.10	1.26	0.21	0.39	0.34	0.36	0.26	0.59	0.34	< MDA	1.29
WL-105	10	6.94	0.14	< MDA	5.05	6.64	0.16	522	0.9	40.8	0.6	40	0.7	40.2	0.6	83.4	7.3
	30	1.10	0.08	1.86	1.38	1.16	0.10	1.59	0.31	0.99	0.34	0.89	0.26	< MDA	0.63	1.77	1.22
WL106	0	105	2	< MDA	18.75	105	3	9700	11.8	906	2	650	13	908	2	1040	23
	5	6.69	2.73	< MDA	2.76	11.5	4.0	731	0.21	18.8	0.4	19.1	2.0	18.1	0.4	47.5	3.4
	5 DUP (F)	26.4	17.2	< MDA	8.02	< MDA	35.3	766	0.14	128	1.0	110	6.0	128	1	212	10
	25	2.89	0.06	< MDA	2.02	2.7	0.06	2.38	0.14	1.26	0.4	1.62	0.29	1.06	0.40	< MDA	1.96
	25 DUP (F)	2.08	0.17	< MDA	3.82	1.9	0.18	6.49	0.12	2.92	0.31	2.94	0.33	< MDA	0.92	< MDA	26.9
WL-107	5	0.89	0.11	1.98	1.09	1.30	0.11	0.89	0.13	0.80	0.29	0.86	0.23	0.57	0.29	< MDA	1.52
	51	0.33	0.08	< MDA	1.15	0.54	0.08	0.56	0.15	0.71	0.36	0.80	0.24	< MDA	0.61	< MDA	1.98
	51 DUP (L)	0.59	0.08	< MDA	1.29	0.34	0.08	0.67	0.23	0.42	0.38	0.47	0.23	< MDA	0.51	2.06	1.65
WL-108	5	1.05	0.12	< MDA	1.22	0.74	0.10	1.21	0.16	0.95	0.37	0.96	0.29	< MDA	0.67	< MDA	2.11
WL-109	5	0.66	0.07	< MDA	1.22	0.66	0.08	0.67	0.13	0.90	0.31	0.92	0.23	< MDA	0.63	< MDA	1.35
	50	0.99	0.12	< MDA	1.81	0.57	0.11	1.1	0.2	0.95	0.30	1.01	0.29	< MDA	0.58	2.06	1.96
	50 DUP (L)	1.13	0.12	< MDA	3.94	0.83	0.11	2.43	0.26	1.36	0.56	1.47	0.47	< MDA	0.99	< MDA	46.3
WL-110	5	0.87	0.09	< MDA	1.47	1.25	0.09	0.66	0.23	0.87	0.40	1.17	0.32	< MDA	0.66	< MDA	2.42
	50	1.14	0.23	< MDA	1.25	1.17	0.20	0.87	0.12	1.01	0.31	1.2	0.28	1.04	0.30	< MDA	1.91

TABLE 2 - 6a
 SOIL ANALYTICAL RESULTS - URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g]) -
 METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
 WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration																	
Surface Samples		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Subsurface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
WL-111	0	1.04	0.18	1.72	1.27	1.70	0.25	2.12	0.29	0.91	0.33	1.05	0.32	0.96	0.33	1.82	1.79
	5	1.16	0.90	1.43	1.29	3.37	0.97	2.76	0.77	0.61	0.42	1.05	0.32	< MDA	0.54	< MDA	1.62
	5 DUP (L)	—	—	—	—	—	—	—	—	0.91	0.41	1.03	0.32	0.81	0.41	< MDA	1.96
	51	< MDA	0.48	< MDA	1.11	0.75	0.53	2.47	0.79	0.48	0.33	0.49	0.30	< MDA	0.55	< MDA	1.55
	51 DUP (L)	—	—	—	—	—	—	—	—	0.51	0.35	0.51	0.26	< MDA	0.54	< MDA	1.60
WL-112	0	1.22	0.12	< MDA	1.63	1.45	0.13	2.67	0.25	1.32	0.41	1.30	0.37	1.33	0.41	< MDA	2.31
	5	3.44	0.42	< MDA	2.55	2.92	0.89	84.4	1.9	4.66	0.42	5.14	0.34	4.35	0.42	11.2	2.90
	42	1.62	0.88	< MDA	1.74	1.74	1.06	0.92	0.42	0.76	0.34	0.90	0.26	0.61	0.34	< MDA	1.40
WL-113	5	1.25	0.26	0.58	0.46	1.40	0.32	0.33	0.11	0.97	0.06	0.88	0.06	1.06	0.06	< MDA	1.26
	5 DUP (F)	0.62	0.08	0.83	0.31	0.76	0.16	0.58	0.15	1.06	0.06	1.05	0.05	1.06	0.06	1.41	0.44
	10	1.06	0.09	< MDA	1.29	1.20	0.22	2.21	0.13	1.53	0.12	1.65	0.12	1.40	0.12	< MDA	11.40
WL-114	0	147	0.9	55.9	7.9	154	1.0	7853	0.92	109	0.9	108	1	110	0.9	206	8
	5	3.54	0.51	< MDA	0.73	3.43	0.63	23.2	0.4	2.59	0.06	2.52	0.25	2.60	0.06	3.29	0.95
	5 DUP (L)	—	—	—	—	—	—	—	—	2.54	0.07	2.49	0.08	2.53	0.07	< MDA	2.34
	15	1.60	0.23	< MDA	0.72	1.29	0.56	1.08	0.28	0.98	0.07	0.99	0.07	0.97	0.07	< MDA	1.41
	15 DUP (L)	—	—	—	—	—	—	—	—	0.97	0.07	0.97	0.09	0.97	0.07	< MDA	2.74
WL-115	5	1.22	0.21	< MDA	0.31	1.30	0.29	0.84	0.18	1.00	0.06	0.99	0.06	0.99	0.06	0.98	0.49
	40	0.33	0.11	0.52	0.25	0.35	0.16	0.29	0.12	0.58	0.05	0.59	0.05	0.58	0.05	0.72	0.40
WL-116	0	0.88	0.15	< MDA	3.84	1.04	0.20	1.94	0.52	0.94	0.33	0.94	0.29	< MDA	0.61	< MDA	29.9
	5	1.18	0.41	1.07	0.31	1.15	0.36	0.51	0.13	1.11	0.06	1.13	0.06	1.07	0.06	1.44	0.48
	5 DUP (F)	1.03	0.20	< MDA	1.52	0.64	0.28	0.35	0.11	1.18	0.13	1.11	0.13	1.24	0.13	< MDA	11.30
	10	1.32	0.05	0.73	0.31	1.14	0.17	0.36	0.21	1.00	0.05	1.02	0.04	0.98	0.05	1.15	0.39
WL-117	10	2.90	0.16	1.44	0.59	1.72	0.25	36.58	0.13	3.15	0.07	2.92	0.08	3.22	0.07	5.82	0.87
	25	0.56	0.10	< MDA	0.58	0.56	0.17	0.7	0.15	0.62	0.05	0.58	0.06	0.68	0.05	< MDA	1.14
WL-118	5	17.8	0.2	< MDA	5.05	15.6	0.2	425	2.5	18.4	0.3	19.9	0.3	18.4	0.3	< MDA	40.3
	10	1.14	0.17	0.82	0.31	1.18	0.18	7.19	0.2	1.31	0.05	1.24	0.05	1.17	0.05	0.97	0.54
WL-119	5	0.72	0.17	0.85	0.33	0.51	0.21	0.6	0.22	0.89	0.06	0.89	0.05	0.91	0.06	1.06	0.45
	50	< MDA	0.58	< MDA	0.23	0.85	0.50	0.67	0.41	0.46	0.04	0.44	0.04	0.48	0.04	< MDA	0.35
	50 DUP (L)	—	—	—	—	—	—	—	—	0.48	0.06	0.49	0.06	0.46	0.06	< MDA	2.39
	50 DUP (F)	0.36	0.25	0.5	0.24	0.57	0.19	0.22	0.11	0.45	0.06	0.43	0.04	0.46	0.06	0.62	0.37
WL-120	5	0.95	0.18	0.85	0.45	1.15	0.26	0.48	0.12	1.00	0.07	0.96	0.07	1.04	0.07	< MDA	0.78
	50	0.52	0.12	< MDA	1.17	0.46	0.14	0.32	0.15	0.92	0.11	0.85	0.11	1.04	0.11	< MDA	9.35
	50 DUP (F)	0.92	0.38	0.76	0.64	0.98	0.35	0.38	0.21	1.07	0.09	1.05	0.08	1.11	0.09	1.03	0.81

TABLE 2 - 6a
 SOIL ANALYTICAL RESULTS - URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g]) -
 METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
 WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration																	
Surface Samples		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Subsurface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
BACKGROUND SURFACE SOIL																	
Barrow Pit - loess	0	1.30	0.19	1.15	1.04	1.06	0.20	0.92	0.37	1.19	0.29	1.07	0.23	< MDA	0.75	2.40	1.31
Barrow Pit - shale	0	1.85	0.25	1.99	1.08	2.40	0.36	1.41	0.18	0.97	0.34	1.01	0.26	0.90	0.34	1.88	1.23
Farmer's Field	0	1.41	0.15	< MDA	1.80	1.11	0.20	2.03	0.17	1.13	0.35	1.02	0.35	1.27	0.35	3.16	2.04
McLaren/Hart Shop	0	0.74	0.14	< MDA	1.35	1.32	0.23	1.68	0.32	0.95	0.31	0.92	0.31	< MDA	0.70	< MDA	1.79

* = Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides, they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

— = Not reported

DUP (F) = Field duplicate

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

NE = Not Established

Bolded numbers indicate result reported above the minimum detectable activity (MDA).

TABLE 2 - 6b
SOIL ANALYTICAL RESULTS - URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g]) -
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration																	
Surface Samples		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Subsurface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
AREA 2																	
WL-201	5	1.19	0.17	<MDA	1.30	0.88	0.18	1.06	0.15	1.06	0.34	1.21	0.26	0.95	0.34	2.38	1.67
	15	0.31	0.12	<MDA	2.35	0.42	0.13	0.63	0.11	0.47	0.24	0.53	0.28	<MDA	0.47	<MDA	26.9
WL-202	5	0.88	0.12	1.27	1.02	1.31	0.15	0.83	0.11	0.75	0.54	0.75	0.49	1.02	0.35	<MDA	46.8
	5 DUP (L)	0.60	0.14	<MDA	1.02	1.31	0.18	0.53	0.09	0.94	0.35	0.87	0.30	<MDA	0.35	<MDA	1.21
	15	0.24	0.10	<MDA	3.75	0.37	0.11	0.26	0.08	<MDA	0.81	<MDA	0.70	<MDA	0.81	<MDA	42.6
WL-203	0	1.95	0.20	1.46	1.43	1.72	0.26	3.03	0.15	1.07	0.38	1.09	0.28	<MDA	0.72	<MDA	1.95
	5	0.95	0.11	<MDA	1.48	0.89	0.14	0.8	0.1	0.94	0.33	0.85	0.3	<MDA	0.59	2.08	1.99
	15	0.60	0.12	<MDA	1.86	0.33	0.13	0.41	0.11	0.53	0.33	<MDA	0.47	0.43	0.33	<MDA	2.12
WL-204	5	0.77	0.08	<MDA	1.03	0.94	0.14	0.77	0.09	1.06	0.31	1.03	0.24	<MDA	0.66	<MDA	1.62
	25	0.36	0.09	<MDA	1.04	0.41	0.10	0.43	0.08	0.77	0.36	0.86	0.28	0.88	0.36	<MDA	1.21
WL-205	5	1.76	0.09	1.48	0.92	1.35	0.14	0.80	0.11	0.95	0.26	1.06	0.26	<MDA	0.62	<MDA	1.34
	15	0.95	0.10	1.76	1.52	1.55	0.14	1.01	0.25	0.90	0.34	0.94	0.30	<MDA	0.68	<MDA	2.22
WL206	0	4.17	0.26	<MDA	2.53	4.05	0.28	429	0.7	17.2	0.4	18.0	0.4	17.4	0.4	49.6	3.1
	5	1.17	0.06	<MDA	4.01	1.3	0.06	7.51	0.23	1.20	0.57	1.36	0.57	0.88	0.57	<MDA	50.7
	10	0.6	0.04	1.83	1.04	0.66	0.07	1.66	0.21	0.72	0.28	0.61	0.22	0.82	0.28	<MDA	1.28
WL-207	5	0.66	0.20	1.6	1.07	0.8	0.22	1.21	0.54	<MDA	0.93	0.68	0.48	<MDA	0.93	<MDA	50.2
	5 DUP (L)	0.89	0.21	1.60	1.07	0.85	0.23	1.12	0.88	0.68	0.24	0.75	0.24	0.49	0.24	<MDA	1.28
	10	0.81	0.21	<MDA	1.12	0.71	0.21	1.78	1.45	0.76	0.33	0.95	0.23	0.57	0.33	<MDA	1.31
WL-208	5	1.60	0.10	<MDA	3.92	2.05	0.12	123	0.10	3.26	0.37	3.39	0.33	3.05	0.37	<MDA	26.9
	5 DUP (L)	2.82	0.13	2.64	1.66	2.27	0.19	94.9	0.23	3.40	0.38	3.29	0.34	3.36	0.38	7.37	2.50
	9	1.75	0.15	2.07	1.59	1.65	0.19	10.07	0.07	1.35	0.25	1.55	0.22	<MDA	0.61	2.08	1.75
WL-209	0	294	0.7	<MDA	93.30	575	0.7	29240	0.10	3720	10	3190	38	3690	10	<MDA	1170
	5	249	0.14	<MDA	66.82	335	0.19	38280	40.2	2970	7	685	34	3000	7	<MDA	810
	5 DUP (F)	287	0.15	49.4	21.8	527	0.20	32680	29.0	3140	5	1080	26	3150	5	1170	28
	25	0.58	0.12	<MDA	3.07	0.46	0.23	26.9	0.12	0.85	0.29	0.91	0.29	0.78	0.29	<MDA	26.9
	25 DUP (F)	0.61	0.08	<MDA	1.28	0.59	0.09	12.85	0.72	0.62	0.27	0.61	0.26	<MDA	0.50	2.94	1.59

TABLE 2 - 6b
SOIL ANALYTICAL RESULTS - URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g]) -
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Surface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
WL-210	0	134	0.6	<MDA	29.51	216	0.7	18190	15.1	2280	4	1450	22	2300	4	1370	28
	5	65.5	0.12	<MDA	32.11	145	0.18	12400	0.14	520	3	546	3	512	3	<MDA	372
	5 DUP (F)	128	0.14	13.2	8.9	267	0.17	15610	0.11	458	2	368	2	468	2	583	12
	40	0.91	0.11	<MDA	1.25	0.69	0.12	18.2	0.12	0.68	0.31	0.80	0.28	0.62	0.31	<MDA	1.90
	40 DUP (F)	0.54	0.09	<MDA	3.94	0.93	0.11	10.8	0.1	1.66	0.59	1.82	0.45	1.40	0.59	<MDA	57.9
WL-211	5	2.61	0.11	<MDA	1.98	2.30	0.10	66.11	0.15	8.52	0.33	8.47	0.32	8.01	0.33	22.4	2.1
	25	0.66	0.26	<MDA	2.85	0.68	0.26	4.97	0.16	0.42	0.31	<MDA	0.40	<MDA	0.46	<MDA	26.9
WL-212	5	1.66	0.12	<MDA	3.74	1.57	0.17	5.73	0.10	1.26	0.46	<MDA	0.83	1.20	0.46	<MDA	46.9
	10	1.77	0.12	<MDA	1.19	1.86	0.14	116	0.23	1.77	0.28	1.95	0.26	1.63	0.28	4.02	1.34
WL-213	0	1.53	0.42	2.05	1.51	1.64	0.45	24.2	0.2	1.00	0.37	1.28	0.28	<MDA	0.70	2.36	2.13
	5	1.53	0.13	<MDA	3.50	1.00	0.19	17.29	0.16	1.26	0.27	1.32	0.30	<MDA	0.63	<MDA	26.9
	25	0.45	0.13	<MDA	3.63	1.06	0.14	3.13	0.05	0.93	0.52	1.06	0.44	<MDA	0.85	<MDA	50.3
WL-214	5	0.81	0.09	1.14	1.08	1.09	0.12	44.4	0.21	0.95	0.22	1.01	0.23	<MDA	0.62	<MDA	1.23
	25	0.67	0.12	<MDA	3.23	0.97	0.11	12.8	0.18	<MDA	0.52	0.74	0.32	<MDA	0.52	<MDA	26.9
WL-215	0	1.53	0.45	<MDA	1.39	1.86	0.48	5.35	0.07	0.70	0.29	0.75	0.28	0.58	0.29	<MDA	1.75
WL-216	5	11.4	2.20	<MDA	7.06	12.5	1.90	1131	0.93	88.4	0.9	85.9	4.6	93.2	0.9	176	9
	25	0.97	0.09	<MDA	1.04	0.81	0.09	1.46	0.17	1.03	0.39	0.93	0.29	1.17	0.39	<MDA	1.43
WL-217	5	0.51	0.08	<MDA	1.80	0.45	0.08	0.96	0.13	0.60	0.31	0.53	0.25	<MDA	0.52	1.71	1.36
	10	0.96	0.12	<MDA	1.10	1.03	0.17	8.95	0.12	1.27	0.29	1.30	0.28	1.24	0.29	2.11	1.38
WL-218	0	1.12	0.16	0.98	0.82	1.53	0.24	1.77	0.14	1.06	0.24	1.07	0.21	1.02	0.24	1.90	1.28
	5	0.81	0.12	<MDA	1.67	0.73	0.12	1.19	0.14	0.85	0.41	0.94	0.34	1.00	0.41	<MDA	2.36
	40	0.53	0.11	<MDA	1.56	0.84	0.12	7.27	0.1	0.68	0.43	0.62	0.28	<MDA	0.60	1.76	0.16
WL-219	5	1.09	0.09	<MDA	1.82	0.91	0.09	1.07	0.15	1.12	0.33	1.32	0.36	1.06	0.33	<MDA	2.41
	10	0.60	0.33	1.93	1.06	1.16	0.39	0.64	0.08	0.62	0.41	0.86	0.31	<MDA	0.55	<MDA	1.46
WL-220	5	1.00	0.09	<MDA	1.60	1.16	0.09	1.53	0.11	0.81	0.36	0.90	0.31	<MDA	0.61	<MDA	2.04
	25	0.95	0.13	<MDA	1.22	0.89	0.12	0.56	0.11	0.78	0.38	0.82	0.36	<MDA	0.66	<MDA	1.55
WL-221	5	0.82	0.13	<MDA	1.59	1.12	0.13	4.28	0.24	0.75	0.34	0.92	0.30	0.81	0.34	<MDA	2.08
	35	0.50	0.11	<MDA	1.62	0.52	0.1	1.24	0.16	<MDA	0.33	<MDA	0.35	<MDA	0.51	<MDA	2.21

TABLE 2 - 6b
 SOIL ANALYTICAL RESULTS - URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g]) -
 METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
 WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration																	
Surface Samples		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Subsurface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
WL-222	0	3.36	0.42	<MDA	5.69	2.26	0.25	131	0.19	2.94	0.53	2.41	0.63	3.56	0.51	<MDA	69.0
	5	1.21	0.09	1.41	1.20	1.46	0.13	81.4	0.76	1.80	0.29	1.85	0.27	1.81	0.29	4.45	1.42
	30	0.40	0.12	<MDA	3.57	0.51	0.12	0.88	0.21	0.82	0.60	<MDA	0.74	<MDA	0.60	<MDA	51.2
WL-223	5	1.22	0.10	<MDA	1.82	1.44	0.11	9.16	0.12	1.73	0.30	1.77	0.31	1.82	0.30	<MDA	2.15
	22	1.93	0.15	<MDA	1.62	2.37	0.14	0.68	0.12	0.52	0.33	0.61	0.29	<MDA	0.50	<MDA	1.65
WL-224	5	0.63	0.40	<MDA	1.45	0.75	0.68	2.85	1.15	0.84	0.28	0.73	0.30	0.93	0.28	<MDA	1.71
	35	0.77	0.52	<MDA	1.92	1.13	0.80	4.08	0.84	1.00	0.37	1.18	0.32	0.84	0.37	1.94	1.70
WL-225	5	1.29	1.01	<MDA	1.40	3.17	1.22	2.84	1.32	1.07	0.40	1.11	0.30	0.93	0.40	2.73	1.82
	35	<MDA	0.77	<MDA	1.66	0.72	0.40	0.91	0.23	<MDA	0.51	0.54	0.41	<MDA	0.72	<MDA	2.17
WL-226	10	1.63	0.29	<MDA	2.17	1.38	0.52	14.1	1.1	1.4	0.34	1.40	0.36	1.25	0.34	4.35	2.10
	20	6.32	0.91	2.55	2.31	6.02	1.31	173	1.0	3.26	0.40	3.26	0.42	<MDA	1.21	5.93	2.62
WL-227	5	2.01	0.32	<MDA	1.53	1.68	0.57	20.4	0.9	1.32	0.29	1.38	0.26	0.92	0.29	2.35	1.45
	40	<MDA	0.53	<MDA	0.98	0.66	0.55	2.78	0.94	0.43	0.24	0.51	0.25	<MDA	0.54	1.81	1.14
WL-228	5	1.84	1.3	<MDA	1.18	1.50	1.57	2.72	1.05	0.79	0.30	0.75	0.29	0.79	0.30	<MDA	1.35
	15	<MDA	0.78	<MDA	2.01	<MDA	0.74	2.13	0.46	0.64	0.37	0.60	0.33	<MDA	0.63	<MDA	2.17
WL-229	5	1.45	0.39	1.81	1.29	0.82	0.52	4.97	0.97	1.15	0.70	0.98	0.26	<MDA	0.70	1.82	1.78
	20	0.54	0.39	<MDA	1.19	0.79	0.56	1.17	1.02	0.38	0.34	0.45	0.24	<MDA	0.50	<MDA	2.07
WL-230	5	0.92	0.16	<MDA	2.05	2.23	0.49	26.8	1.3	1.67	0.34	1.56	0.28	1.93	0.34	2.26	1.97
	35	2.05	0.46	<MDA	1.86	1.75	1.18	1.33	1.25	0.53	0.36	0.33	0.29	<MDA	0.52	<MDA	1.60
WL-231	0	2.04	0.26	<MDA	3.26	3.18	0.32	1.21	0.20	0.91	0.29	1.01	0.30	<MDA	0.57	<MDA	29.9
	5	3.86	2.18	2.48	1.41	6.97	2.14	94.5	1.0	4.06	0.28	3.96	0.34	4.18	0.28	5.59	1.70
	10	2.01	0.15	<MDA	1.39	2.29	0.53	10.2	1.4	1.37	0.40	1.42	0.27	<MDA	0.71	2.73	1.80
WL-233	27	4.48	1.80	2.03	1.97	4.58	1.64	427	0.70	4.44	0.38	4.26	0.36	4.43	0.38	9.83	2.87
	30	1.99	1.93	<MDA	1.74	2.60	2.34	9.93	0.9	0.79	0.41	0.87	0.34	0.76	0.41	1.89	1.69
WL-234	10	138	5.0	24.5	19.9	128	5	57300	238	3060	4	1100	25	3060	4	1300	24
	10 DUP (F)	60.7	1.1	<MDA	14.65	45.4	0.5	12000	116	1260	3	592	16	1260	3	839	18
	20	0.98	0.28	<MDA	1.70	0.94	0.37	16.2	0.04	<MDA	0.66	1.18	0.31	<MDA	0.66	<MDA	2.20
	20 DUP (F)	2.11	0.99	2.08	1.7	1.64	0.99	11.3	0.5	1.18	0.39	0.99	0.32	1.34	0.39	<MDA	2.15

TABLE 2 - 8a
SOIL ANALYTICAL DATA - THORIUM-232 DECAY SERIES (picocuries per gram [pCi/g])
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-228		Radium-224		Lead-212		Bismuth-212		Thallium 208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration		6.55		7.37		6.33		5		7.26		5		5.71	
Surface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
Subsurface Samples															
AREA 1															
WL-101	5	0.89	0.07	< MDA	0.95	1.25	0.13	< MDA	3.82	0.62	0.19	< MDA	1.29	0.26	0.17
	20	1.45	0.19	< MDA	1.08	1.13	0.32	2.86	2.15	0.98	0.19	< MDA	1.68	0.31	0.13
WL-102	5	0.90	0.14	< MDA	0.99	1.05	0.35	3.0	2.02	0.97	0.20	< MDA	1.53	< MDA	0.28
	15	1.64	0.2	< MDA	1.07	0.83	0.38	< MDA	4.49	1.04	0.29	< MDA	1.98	< MDA	0.33
WL-103	5	0.78	0.17	< MDA	1.19	1.12	0.32	< MDA	4.80	0.96	0.23	< MDA	1.89	< MDA	0.31
	10	0.77	0.09	< MDA	1.26	0.30	0.14	< MDA	3.75	0.56	0.33	< MDA	2.45	< MDA	0.36
WL-104	5	0.94	0.19	< MDA	0.84	1.07	0.27	< MDA	1.29	0.61	0.16	< MDA	1.26	0.27	0.13
	20	0.77	0.14	< MDA	0.92	0.68	0.34	< MDA	2.77	0.81	0.20	< MDA	1.65	0.23	0.16
WL-105	10	4.34	1.36	< MDA	1.59	< MDA	2.18	< MDA	11.75	< MDA	0.73	< MDA	2.82	< MDA	0.39
	30	1.04	0.15	< MDA	1.18	1.02	0.41	< MDA	4.68	1.18	0.19	< MDA	1.66	0.36	0.14
WL106	0	35.2	11.2	< MDA	5.86	< MDA	7.99	1760	24	< MDA	2.90	< MDA	10.20	< MDA	1.32
	5	3.22	0.2	1.42	1.07	0.29	0.18	< MDA	7.30	0.77	0.4	< MDA	1.99	0.42	0.27
	5 DUP (F)	4.71	0.12	< MDA	2.69	0.39	0.11	< MDA	20.49	< MDA	1.17	4.50	4.16	< MDA	0.63
	25	0.56	0.09	< MDA	1.18	0.55	0.17	< MDA	1.18	1.01	0.19	< MDA	1.91	< MDA	0.28
	25 DUP (F)	0.47	0.09	< MDA	1.16	0.5	0.13	< MDA	5.33	0.68	0.37	< MDA	1.62	0.33	0.18
WL-107	5	0.89	0.09	0.91	0.68	0.5	0.18	2.26	2.12	1.06	0.19	< MDA	1.67	0.37	0.14
	51	0.14	0.09	< MDA	0.98	0.36	0.19	2.34	1.92	0.64	0.17	< MDA	1.84	0.24	0.2
	51 DUP (L)	0.22	0.13	< MDA	1.11	0.17	0.21	< MDA	3.94	0.68	0.23	< MDA	1.74	0.24	0.20
WL-108	5	0.79	0.12	< MDA	1.34	0.83	0.16	3.32	2.50	0.88	0.22	< MDA	1.84	0.35	0.23
WL-109	5	0.21	0.11	1.18	0.62	0.25	0.18	3.15	2.20	1.0	0.19	< MDA	1.82	0.28	0.17
	50	0.58	0.21	1.36	0.71	0.72	0.17	< MDA	2.34	1.0	0.21	< MDA	1.47	0.28	0.17
	50 DUP (L)	1.13	0.12	< MDA	1.51	0.83	0.11	< MDA	5.87	0.7	0.40	< MDA	2.29	< MDA	0.39
WL-110	5	0.37	0.16	< MDA	1.27	< MDA	0.23	3.78	2.29	1.1	0.20	1.90	1.44	0.35	0.21
	50	0.87	0.08	< MDA	1.92	0.75	0.14	3.29	2.41	0.81	0.21	< MDA	1.47	< MDA	0.23
WL-111	0	0.68	0.20	< MDA	1.05	0.41	0.30	< MDA	4.43	0.97	0.22	< MDA	1.88	0.33	0.19
	5	< MDA	0.7	< MDA	1.02	< MDA	0.77	< MDA	2.26	1.10	0.20	< MDA	1.74	0.33	0.18
	5 DUP (L)	-	-	< MDA	1.36	< MDA		< MDA	4.38	0.74	0.25	< MDA	1.54	0.31	0.2
	51	< MDA	0.58	< MDA	1.10	< MDA	0.92	< MDA	3.17	0.28	0.22	< MDA	1.91	< MDA	0.21
	51 DUP (L)	-	-	< MDA	1.01	< MDA		< MDA	3.57	0.53	0.21	< MDA	1.39	< MDA	0.21

TABLE 2 - 8a
 SOIL ANALYTICAL DATA - THORIUM-232 DECAY SERIES (picocuries per gram (pCi/g))
 METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
 WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-228		Radium-224		Lead-212		Bismuth-212		Thallium 208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration		6.55		7.37		6.33		5		7.26		5		5.71	
Surface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
WL-112	0	0.84	0.19	<MDA	1.18	0.89	0.19	2.95	2.61	1.36	0.23	<MDA	1.81	0.34	0.30
	5	<MDA	1.56	<MDA	1.20	1.55	1.48	<MDA	6.16	1.08	0.28	<MDA	2.02	0.43	0.21
	42	0.68	0.3	1.31	0.58	<MDA	0.58	2.24	2.14	0.70	0.19	<MDA	1.73	0.38	0.16
WL-113	5	0.19	0.08	1.06	0.13	0.21	0.11	3.49	0.58	1.04	0.05	0.80	0.27	0.36	0.04
	5 DUP (F)	0.15	0.08	0.98	0.13	<MDA	0.14	2.86	0.48	1.00	0.04	1.06	0.23	0.31	0.03
	10	0.08	0.08	0.98	0.24	0.13	0.1	<MDA	2.15	0.82	0.10	0.90	0.59	0.29	0.06
WL-114	0	18.1	0.78	<MDA	2.50	1.96	0.99	<MDA	12.42	<MDA	1.85	<MDA	3.90	0.79	0.51
	5	<MDA	0.26	0.39	0.16	0.33	0.26	6.15	0.68	0.43	0.06	<MDA	0.35	0.16	0.04
	5 DUP (L)	-	-	0.46	0.15	-	-	5.59	0.08	0.48	0.07	0.35	0.27	0.16	0.04
	15	<MDA	0.2	1.04	0.14	0.35	0.27	3.14	0.65	0.99	0.06	0.84	0.30	0.35	0.04
	15 DUP (L)	-	-	1.08	0.15	-	-	2.71	0.77	1.01	0.07	<MDA	1.39	0.35	0.04
WL-115	5	0.21	0.11	0.93	0.12	0.32	0.14	3.02	0.50	0.81	0.04	0.50	0.27	0.29	0.03
	40	0.27	0.09	0.69	0.10	0.19	0.05	1.80	0.042	0.70	0.04	0.57	0.20	0.19	0.03
WL-116	0	0.52	0.46	<MDA	1.19	0.54	0.39	<MDA	5.22	0.73	0.31	<MDA	1.54	0.35	0.15
	5	0.25	0.04	0.94	0.14	0.39	0.07	2.93	0.52	0.89	0.05	0.64	0.29	0.3	0.04
	5 DUP (F)	0.21	0.07	1.0	0.28	0.33	0.12	<MDA	2.26	1.02	0.10	0.89	0.61	0.37	0.07
	10	0.33	0.13	0.76	0.11	0.25	0.14	2.74	0.40	0.71	0.04	0.44	0.19	0.24	0.03
WL-117	10	1	0.12	0.64	0.16	0.47	0.18	6.48	0.71	0.58	0.06	<MDA	0.40	0.16	0.04
	25	0.2	0.12	0.64	0.12	0.39	0.16	1.92	0.52	0.59	0.05	0.64	0.21	0.18	0.03
WL-118	5	10.3	2.22	<MDA	0.73	<MDA	1.99	39.1	3.6	<MDA	0.55	<MDA	1.33	<MDA	0.17
	10	0.35	0.2	0.49	0.14	0.34	0.23	0.47	0.43	0.49	0.04	0.39	0.23	0.17	0.03
WL-119	5	0.26	0.13	0.73	0.12	0.3	0.2	2.68	0.48	0.79	0.04	<MDA	0.34	0.29	0.03
	50	<MDA	0.41	0.41	0.10	<MDA	0.3	1.77	0.34	0.51	0.03	0.42	0.20	0.15	0.02
	50 DUP (L)	-	-	0.44	0.12	-	-	1.83	0.55	0.49	0.05	<MDA	0.25	0.13	0.03
	50 DUP (F)	0.1	0.09	0.50	0.12	0.15	0.09	1.66	0.39	0.47	0.03	0.33	0.23	0.17	0.03
WL-120	5	0.14	0.09	1.08	0.16	0.26	0.08	3.11	0.65	1.01	0.06	0.88	0.34	<MDA	0.04
	50	0.23	0.13	0.91	0.22	<MDA	0.2	<MDA	1.96	1.12	0.08	<MDA	0.64	0.32	0.07
	50 DUP (F)	0.25	0.15	1.04	0.17	0.26	0.13	3.07	0.67	1.00	0.06	0.75	0.39	0.33	0.04

TABLE 2 - 8a
 SOIL ANALYTICAL DATA - THORIUM-232 DECAY SERIES (picocuries per gram [pCi/g])
 METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
 WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-228		Radium-224		Lead-212		Bismuth-212		Thallium 208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration															
Surface Samples		6.55		7.37		6.33		5		7.26		5		5.71	
Subsurface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
BACKGROUND SURFACE SOIL															
Barrow Pit - loess	0	0.75	0.22	1.39	0.64	0.58	0.33	<MDA	2.99	1.33	0.18	<MDA	1.71	0.38	0.16
Barrow Pit - shale	0	1.26	0.14	1.90	0.64	1.16	0.13	<MDA	3.54	1.94	0.23	<MDA	1.61	0.63	0.18
Farmer's Field	0	1.05	0.1	<MDA	1.14	0.56	0.20	<MDA	5.03	0.80	0.36	<MDA	2.17	0.32	0.22
McLaren/Hart Shop	0	0.52	0.18	<MDA	1.24	0.43	0.24	<MDA	3.85	1.09	0.21	<MDA	1.75	0.41	0.18

* = Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides, they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

— = Not reported

DUP (F) = Field duplicate

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

NE = Not established

Bolded numbers indicate result reported above minimum detectable activity

TABLE 2 - 8b
SOIL ANALYTICAL DATA - THORIUM-232 DECAY SERIES (picocuries per gram (pCi/g))
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-228		Radium-224		Lead-212		Bismuth-212		Thallium 208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration															
Surface Samples		6.55		7.37		6.33		5		7.26		5		5.71	
Subsurface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
AREA 2															
WL-201	5	0.32	0.13	< MDA	1.13	0.24	0.15	< MDA	4.46	1.04	0.21	< MDA	1.62	0.31	0.19
	15	0.28	0.08	< MDA	0.73	0.43	0.15	< MDA	2.16	0.49	0.19	< MDA	1.31	0.21	0.16
WL-202	5	0.44	0.09	< MDA	1.59	0.75	0.16	12.0	4.0	0.97	0.16	< MDA	2.86	0.42	0.26
	5 DUP (L)	0.39	0.08	< MDA	1.14	0.17	0.14	4.05	1.88	0.97	0.16	< MDA	1.47	< MDA	0.14
	15	0.16	0.08	< MDA	1.18	0.31	0.14	< MDA	5.09	0.96	0.33	< MDA	2.77	< MDA	0.39
WL-203	0	0.43	0.12	< MDA	1.28	0.75	0.21	< MDA	4.23	1.17	0.26	< MDA	2.02	0.58	0.21
	5	0.14	0.06	< MDA	0.99	0.32	0.18	< MDA	4.07	1.04	0.20	< MDA	1.68	0.20	0.17
	15	0.23	0.08	< MDA	0.98	0.28	0.13	< MDA	3.57	0.52	0.20	< MDA	1.62	< MDA	0.20
WL-204	5	0.47	0.06	0.99	0.56	0.55	0.14	< MDA	2.71	0.85	0.24	< MDA	1.39	0.28	0.16
	25	0.32	0.07	0.85	0.72	0.21	0.18	< MDA	2.05	0.75	0.18	< MDA	1.13	0.22	0.15
WL-205	5	0.66	0.08	< MDA	1.19	0.47	0.13	< MDA	2.95	0.90	0.22	< MDA	1.56	0.30	0.16
	15	0.95	0.15	< MDA	0.95	0.70	0.29	< MDA	4.23	0.89	0.19	< MDA	1.80	< MDA	0.18
WL206	0	11.2	0.6	< MDA	1.21	1.01	0.63	< MDA	7.31	1.09	0.30	< MDA	2.44	0.34	0.25
	5	1.12	0.15	< MDA	1.58	0.91	0.28	< MDA	5.91	0.76	0.41	< MDA	2.92	< MDA	0.42
	10	0.82	0.16	< MDA	0.96	1.06	0.28	< MDA	1.78	1.00	0.16	1.02	0.97	0.40	0.15
WL-207	5	1.42	0.39	< MDA	1.59	< MDA	0.77	< MDA	6.13	1.77	0.36	< MDA	2.86	< MDA	0.32
	5 DUP (L)	1.92	0.59	< MDA	0.97	< MDA	1.44	2.90	2.05	1.06	0.18	< MDA	1.40	0.34	0.17
	10	1.37	1.17	< MDA	1.10	< MDA	1.96	3.11	1.90	1.11	0.17	< MDA	1.14	< MDA	0.25
WL-208	5	1.43	0.08	0.68	0.66	0.96	0.16	< MDA	5.15	0.48	0.25	< MDA	1.23	< MDA	0.27
	5 DUP (L)	0.82	0.14	< MDA	1.03	0.7	0.24	< MDA	4.77	0.84	0.24	< MDA	1.75	0.38	0.22
	9	0.36	0.07	< MDA	0.74	0.36	0.12	3.05	2.25	0.63	0.20	< MDA	1.46	0.22	0.13
WL-209	0	127	0.09	< MDA	21.34	4.97	0.09	6580	95	< MDA	13.80	< MDA	40.36	< MDA	5.77
	5	138	32.2	< MDA	16.34	< MDA	40.1	< MDA	123.9	< MDA	8.56	< MDA	30.10	< MDA	4.28
	5 DUP (F)	180	20.2	16.7	11.3	< MDA	61.7	< MDA	93.04	< MDA	3.33	< MDA	20.68	4.27	2.53
	25	0.71	0.05	< MDA	0.92	0.38	0.25	< MDA	3.79	0.52	0.25	< MDA	1.41	0.22	0.15
	25 DUP (F)	< MDA	0.84	< MDA	0.85	< MDA	1.26	2.68	2.26	0.52	0.20	< MDA	1.15	0.19	0.12
WL-210	0	59.2	17.5	< MDA	9.55	< MDA	13.5	4330	39	< MDA	4.70	< MDA	17.29	< MDA	2.34
	5	106	0.06	< MDA	6.72	3.88	0.08	< MDA	0.52	< MDA	3.64	< MDA	12.76	< MDA	1.78
	5 DUP (F)	120	0.06	< MDA	4.66	4.59	0.05	< MDA	36.13	2.49	1.35	< MDA	7.93	1.13	1.06
	40	0.37	0.08	< MDA	0.33	0.65	0.16	3.00	2.12	0.61	0.19	< MDA	1.19	< MDA	0.15
	40 DUP (F)	0.82	0.07	< MDA	1.45	0.40	0.11	< MDA	5.84	0.43	0.41	< MDA	2.27	< MDA	0.40
WL-211	5	1.38	0.08	< MDA	1.15	0.66	0.08	< MDA	5.48	0.99	0.23	< MDA	1.73	< MDA	0.21
	25	0.32	0.08	< MDA	0.85	0.29	0.2	< MDA	3.51	< MDA	0.33	< MDA	1.47	< MDA	0.21

TABLE 2 - 8b
SOIL ANALYTICAL DATA - THORIUM-232 DECAY SERIES (picocuries per gram [pCi/g])
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-228		Radium-224		Lead-212		Bismuth-212		Thallium 208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration															
Surface Samples		6.55		7.37		6.33		5		7.26		5		5.71	
Subsurface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
WL-212	5	0.29	0.08	< MDA	1.16	0.33	0.14	7.26	3.87	< MDA	0.46	< MDA	2.19	< MDA	0.37
	10	0.9	0.13	< MDA	0.90	0.55	0.17	3.66	2.31	0.47	0.24	< MDA	1.60	< MDA	0.16
WL-213	0	1.11	0.20	< MDA	0.90	0.79	0.22	< MDA	4.09	< MDA	0.37	< MDA	1.54	< MDA	0.22
	5	0.89	0.15	< MDA	0.92	0.67	0.15	< MDA	4.14	0.63	0.27	< MDA	1.48	< MDA	1.65
	25	0.52	0.07	< MDA	1.49	0.64	0.1	< MDA	5.23	< MDA	0.40	< MDA	2.76	0.37	0.29
WL-214	5	0.41	0.14	< MDA	0.81	0.5	0.2	< MDA	2.31	0.62	0.21	< MDA	1.34	0.24	0.17
	25	0.36	0.12	< MDA	0.89	0.48	0.22	< MDA	4.23	0.80	0.22	< MDA	1.37	0.32	0.18
WL-215	0	0.31	0.07	< MDA	0.73	0.27	0.12	3.04	2.41	0.41	0.21	< MDA	1.37	< MDA	0.21
WL-216	5	3.05	0.81	< MDA	2.21	< MDA	1.14	< MDA	18.28	< MDA	1.07	< MDA	4.26	< MDA	0.55
	25	1.17	0.1	1.62	0.54	0.92	0.16	< MDA	2.08	0.81	0.19	< MDA	1.34	0.42	0.18
WL-217	5	< MDA	0.085	< MDA	0.81	< MDA	0.15	< MDA	2.83	< MDA	0.23	< MDA	1.26	< MDA	0.19
	10	0.72	0.11	< MDA	1.04	0.34	0.18	2.57	1.94	1.05	0.17	< MDA	1.36	0.32	0.16
WL-218	0	0.77	0.07	0.82	0.66	0.72	0.11	< MDA	2.64	0.75	0.19	< MDA	1.57	0.36	0.14
	5	0.67	0.12	1.01	0.70	0.82	0.19	< MDA	3.90	0.57	0.34	< MDA	1.79	< MDA	0.17
	40	0.58	0.09	< MDA	1.16	0.86	0.14	< MDA	3.73	1.20	0.22	< MDA	1.85	< MDA	0.29
WL-219	5	1.12	0.14	1.17	0.77	0.98	0.14	< MDA	2.76	1.09	0.24	< MDA	1.84	0.42	0.21
	10	0.44	0.07	< MDA	1.04	0.37	0.13	< MDA	3.23	0.55	0.18	< MDA	1.79	< MDA	0.27
WL-220	5	0.69	0.10	< MDA	1.22	0.51	0.26	< MDA	4.47	0.56	0.33	< MDA	1.79	< MDA	0.28
	25	0.22	0.1	1.25	0.56	0.18	0.18	< MDA	3.72	0.92	0.24	< MDA	1.39	0.44	0.17
WL-221	5	0.7	0.24	< MDA	1.12	0.58	0.22	< MDA	2.54	0.76	0.22	< MDA	1.61	< MDA	0.28
	35	0.63	0.14	< MDA	1.09	0.41	0.15	< MDA	4.15	0.59	0.24	< MDA	1.85	0.21	0.18
WL-222	0	1.31	0.2	< MDA	1.75	0.97	0.16	< MDA	8.22	< MDA	0.53	< MDA	2.91	< MDA	0.45
	5	1.3	0.17	0.83	0.70	0.89	0.12	4.71	2.07	0.78	0.18	< MDA	1.73	< MDA	0.16
	30	1.0	0.15	< MDA	1.27	0.78	0.12	< MDA	5.00	< MDA	0.48	< MDA	2.39	< MDA	0.39
WL-223	5	0.64	0.12	< MDA	1.14	0.36	0.19	< MDA	4.57	0.83	0.31	< MDA	1.64	0.31	0.22
	22	0.18	0.1	< MDA	0.88	< MDA	0.16	< MDA	3.07	0.61	0.22	< MDA	1.62	0.31	0.14
WL-224	5	< MDA	0.91	1.23	0.67	< MDA	1.37	< MDA	2.16	1.17	0.19	1.86	1.81	0.35	0.23
	35	< MDA	0.62	1.19	0.90	< MDA	0.97	2.21	2.12	0.95	0.19	< MDA	1.93	0.49	0.16
WL-225	5	1.76	0.62	< MDA	1.18	< MDA	0.84	2.84	2.23	1.06	0.20	< MDA	2.39	0.50	0.19
	35	0.33	0.16	< MDA	1.50	0.48	0.17	< MDA	5.32	0.49	0.29	< MDA	2.10	0.29	0.26

TABLE 2 - 8b
SOIL ANALYTICAL DATA - THORIUM-232 DECAY SERIES (picocuries per gram [pCi/g])
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-228		Radium-224		Lead-212		Bismuth-212		Thallium 208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration															
Surface Samples		6.55		7.37		6.33		5		7.26		5		5.71	
Subsurface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
WL-226	10	< MDA	0.85	0.95	0.82	< MDA	1.12	< MDA	4.82	1.38	0.27	< MDA	1.85	0.30	0.19
	20	< MDA	0.85	< MDA	1.12	< MDA	0.99	< MDA	5.32	< MDA	0.39	< MDA	2.05	< MDA	0.25
WL-227	5	< MDA	0.53	1.35	0.73	< MDA	0.84	3.48	2.10	1.03	0.23	< MDA	1.76	0.23	0.18
	40	< MDA	0.55	< MDA	0.79	< MDA	0.74	< MDA	2.39	0.67	0.18	< MDA	1.55	0.19	0.13
WL-228	5	< MDA	0.79	1.29	0.62	< MDA	1.04	3.64	2.13	0.98	0.19	< MDA	1.55	0.38	0.17
	15	0.62	0.37	< MDA	1.12	1.01	0.65	< MDA	4.05	0.78	0.27	< MDA	1.76	< MDA	0.19
WL-229	5	1.47	0.89	< MDA	1.24	1.5	0.8	3.30	2.23	1.16	0.20	< MDA	1.89	0.45	0.15
	20	< MDA	0.69	< MDA	0.96	< MDA	1.02	< MDA	3.19	0.54	0.19	< MDA	1.79	< MDA	0.21
WL-230	5	< MDA	0.87	< MDA	1.16	< MDA	1.29	< MDA	3.92	0.88	0.19	< MDA	2.00	0.31	0.19
	35	< MDA	0.75	< MDA	0.89	< MDA	1.17	< MDA	3.32	0.49	0.25	< MDA	1.75	< MDA	0.25
WL-231	0	< MDA	0.19	< MDA	0.92	< MDA	0.14	3.21	2.32	0.35	0.20	< MDA	1.26	< MDA	0.16
	5	1.11	0.83	< MDA	1.02	< MDA	1.26	< MDA	3.95	0.70	0.19	< MDA	1.60	< MDA	0.28
	10	< MDA	0.87	< MDA	0.75	< MDA	0.99	2.23	2.21	0.42	0.19	< MDA	1.48	< MDA	0.24
WL-233	27	1.19	0.56	< MDA	1.11	< MDA	1.02	7.35	3.32	< MDA	2.87	< MDA	1.80	< MDA	0.24
	30	0.82	0.49	< MDA	1.05	< MDA	1.02	< MDA	3.11	0.39	0.20	< MDA	1.64	< MDA	0.23
WL-234	10	< MDA	240	14.5	10.3	< MDA	196	< MDA	87.47	10.8	3.2	< MDA	18.63	3.09	2.26
	10 DUP (F)	< MDA	98.7	< MDA	6.62	< MDA	132	< MDA	56.24	< MDA	2.19	< MDA	11.82	< MDA	1.51
	20	0.67	0.07	< MDA	1.25	0.65	0.12	< MDA	4.56	0.75	0.24	< MDA	1.98	0.25	0.22
	20 DUP (F)	0.85	0.38	< MDA	1.23	0.75	0.38	< MDA	2.58	1.04	0.23	< MDA	1.89	0.25	0.21
WL-235	0	1.03	0.19	1.19	0.56	0.60	0.13	3.40	2.02	1.09	0.18	< MDA	1.76	0.46	0.16
	5	< MDA	0.83	< MDA	1.58	1.2	0.94	< MDA	7.20	1.10	0.41	< MDA	2.99	0.60	0.28
	30	< MDA	0.94	< MDA	0.93	< MDA	0.87	3.11	2.58	0.75	0.23	< MDA	1.68	< MDA	0.28
WL-236	5	< MDA	0.69	< MDA	1.00	1.25	0.56	3.84	2.57	1.10	0.23	1.70	1.57	0.45	0.19
	35	< MDA	1.02	< MDA	1.23	< MDA	0.73	< MDA	4.01	0.95	0.27	< MDA	1.84	0.29	0.17
WL-239	5	0.26	0.07	1.13	0.17	0.23	0.12	< MDA	1.80	1.11	0.09	< MDA	0.55	0.31	0.06
	25	0.31	0.14	0.72	0.12	0.17	0.15	2.48	0.67	0.67	0.06	0.67	0.27	0.18	0.03
WL-241	5	3.84	0.05	< MDA	0.24	0.39	0.23	< MDA	2.14	< MDA	0.88	< MDA	0.42	0.28	0.06
	15	0.18	0.08	0.96	0.16	0.15	0.08	3.61	0.066	1.00	0.06	< MDA	0.41	0.35	0.04
WL-242	0	< MDA	0.34	< MDA	0.77	< MDA	1.1	< MDA	4.25	< MDA	0.28	< MDA	1.63	< MDA	0.24
	2	< MDA	0.75	< MDA	1.57	< MDA	1.19	< MDA	7.62	0.51	0.51	< MDA	2.73	< MDA	0.43
WL-243	0	6.73	0.15	1.13	0.84	1.11	0.15	< MDA	4.33	1.04	0.22	< MDA	1.80	0.46	0.15
WL-244	0	0.78	0.65	< MDA	1.05	< MDA	1.23	< MDA	2.24	0.86	0.2	< MDA	1.43	0.23	0.17

TABLE 2 - 6b
SOIL ANALYTICAL RESULTS - URANIUM-238 DECAY SERIES (picocuries per gram [pCi/g]) -
METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Uranium-238		Thorium-234		Uranium-234		Thorium-230		Radium-226		Lead-214		Bismuth-214		Lead-210	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		2.24		2.76		2.73		2.45		1.30		1.13		1.61		3.77	
Reference Level Concentration																	
Surface Samples		7.24		7.76		7.73		7.45		6.3		6.13		6.61		8.77	
Subsurface Samples		17.24		17.76		17.73		17.45		16.3		16.13		16.61		18.77	
WL-235	0	0.77	0.37	< MDA	1.82	0.97	0.31	12.4	0.13	0.90	0.32	0.94	0.29	< MDA	0.61	1.56	1.47
	5	0.91	0.50	< MDA	4.87	1.47	0.61	3.21	1.16	0.74	0.56	< MDA	0.86	< MDA	0.92	< MDA	59.3
	30	1.31	0.24	< MDA	2.09	1.25	0.41	3.15	1.0	1.09	0.43	1.18	0.29	1.00	0.43	< MDA	2.06
WL-236	5	1.56	0.60	< MDA	2.02	1.43	1.41	5.92	0.97	1.03	0.34	1.14	0.33	< MDA	0.68	< MDA	1.75
	35	1.95	0.82	2.45	1.26	2.37	0.54	4.9	1.01	1.01	0.35	1.02	0.31	< MDA	0.67	1.79	1.77
WL-239	5	1.22	0.14	< MDA	1.13	1.24	0.19	0.5	0.12	0.96	0.10	0.89	0.1	1.01	0.10	< MDA	8.86
	25	0.48	0.47	1.24	0.89	0.83	0.46	0.58	0.25	0.90	0.06	0.83	0.06	0.87	0.06	< MDA	2.65
WL-241	5	3.90	0.18	< MDA	0.94	4.51	0.15	343	0.11	12.9	0.1	12.5	0.1	12.6	0.1	26.7	1.1
	15	0.64	0.13	0.75	0.46	0.59	0.20	0.57	0.13	1.04	0.07	0.98	0.07	1.12	0.07	1.63	0.78
WL-242	0	1.63	0.13	< MDA	3.85	1.83	0.17	8.63	0.76	1.57	0.51	1.59	0.28	1.48	0.51	< MDA	29.8
	2	0.75	0.1	< MDA	4.91	1.35	0.1	21.3	1.11	2.42	0.59	2.45	0.55	< MDA	1.24	< MDA	66.3
WL-243	0	3.63	0.18	< MDA	1.94	3.99	0.24	265	0.22	4.78	0.33	5.26	0.28	4.2	0.33	9.58	2.07
WL-244	0	1.35	0.09	< MDA	1.24	0.88	0.12	20.8	0.71	1.54	0.33	1.58	0.21	1.31	0.33	2.02	1.48
WL-245	0	0.71	0.18	< MDA	1.70	0.93	0.23	3.92	0.16	0.95	0.34	1	0.29	< MDA	0.65	< MDA	2.02
WL-246	0	0.73	0.18	< MDA	1.93	0.94	0.14	2.91	0.3	1.04	0.37	0.91	0.3	1.09	0.37	< MDA	1.63
BACKGROUND SURFACE SOIL																	
Barrow Pit - loess	0	1.30	0.19	1.15	1.04	1.06	0.20	0.92	0.37	1.19	0.29	1.07	0.23	< MDA	0.75	2.40	1.31
Barrow Pit - shale	0	1.85	0.25	1.99	1.08	2.40	0.36	1.41	0.18	0.97	0.34	1.01	0.26	0.90	0.34	1.88	1.23
Farmer's Field	0	1.41	0.15	< MDA	1.80	1.11	0.20	2.03	0.17	1.13	0.35	1.02	0.35	1.27	0.35	3.16	2.04
McLaren/Hart Shop	0	0.74	0.14	< MDA	1.35	1.32	0.23	1.68	0.32	0.95	0.31	0.92	0.31	< MDA	0.70	< MDA	1.79

* = Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides, they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

-- = Not reported

DUP (F) = Field duplicate

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

NE = Not Established

Bolded numbers indicate result reported above the minimum detectable activity (MDA).

TABLE 2 - 8b
 SOIL ANALYTICAL DATA - THORIUM-232 DECAY SERIES (picocuries per gram [pCi/g])
 METHODS NAS-NS-3050, HASL 300, AND NAS-NS-3004
 WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Boring	Depth (feet)	Thorium-232		Radium-228		Thorium-232		Radium-224		Lead-212		Bismuth-212		Thallium-208	
		Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Site Specific Background(Mean+2 Std Dev)		1.55		2.37		1.33		NE		2.26		NE		0.71	
Reference Level Concentration															
Surface Samples		6.55		7.37		6.33		5		7.26		5		5.71	
Subsurface Samples		16.55		17.37		16.33		15		17.26		15		15.71	
WL-245	0	0.38	0.11	< MDA	1.20	0.58	0.16	< MDA	5.06	1.18	0.25	<MDA	2.11	0.5	0.23
WL-246	0	0.63	0.15	< MDA	1.07	0.62	0.2	< MDA	2.70	1.05	0.24	<MDA	1.85	0.34	0.2
BACKGROUND SURFACE SOIL															
Barrow Pit - loess	0	0.75	0.22	1.39	0.64	0.58	0.33	< MDA	2.99	1.33	0.18	< MDA	1.71	0.38	0.16
Barrow Pit - shale	0	1.26	0.14	1.90	0.64	1.16	0.13	< MDA	3.54	1.94	0.23	< MDA	1.61	0.63	0.18
Farmer's Field	0	1.05	0.1	< MDA	1.14	0.56	0.20	< MDA	5.03	0.80	0.36	< MDA	2.17	0.32	0.22
McLaren/Hart Shop	0	0.52	0.18	< MDA	1.24	0.43	0.24	< MDA	3.85	1.09	0.21	< MDA	1.75	0.41	0.18

* = Nuclear Regulatory Commission's Branch Technical Position (BTP) criteria for thorium-230 and radium-226, which are established at levels of background plus 5 pCi/g for surface samples and background plus 15 pCi/g for subsurface samples (15 cm depth), have been selected as reference values for comparison of all soil analytical data. Although this criteria is appropriate specifically for these two radionuclides, they are conservative values for comparison of all data. If no background concentration is established for a specific radionuclide, then a reference value of 5 pCi/g for surface samples and 15 pCi/g for subsurface samples have been conservatively selected for comparison of the data.

-- = Not reported

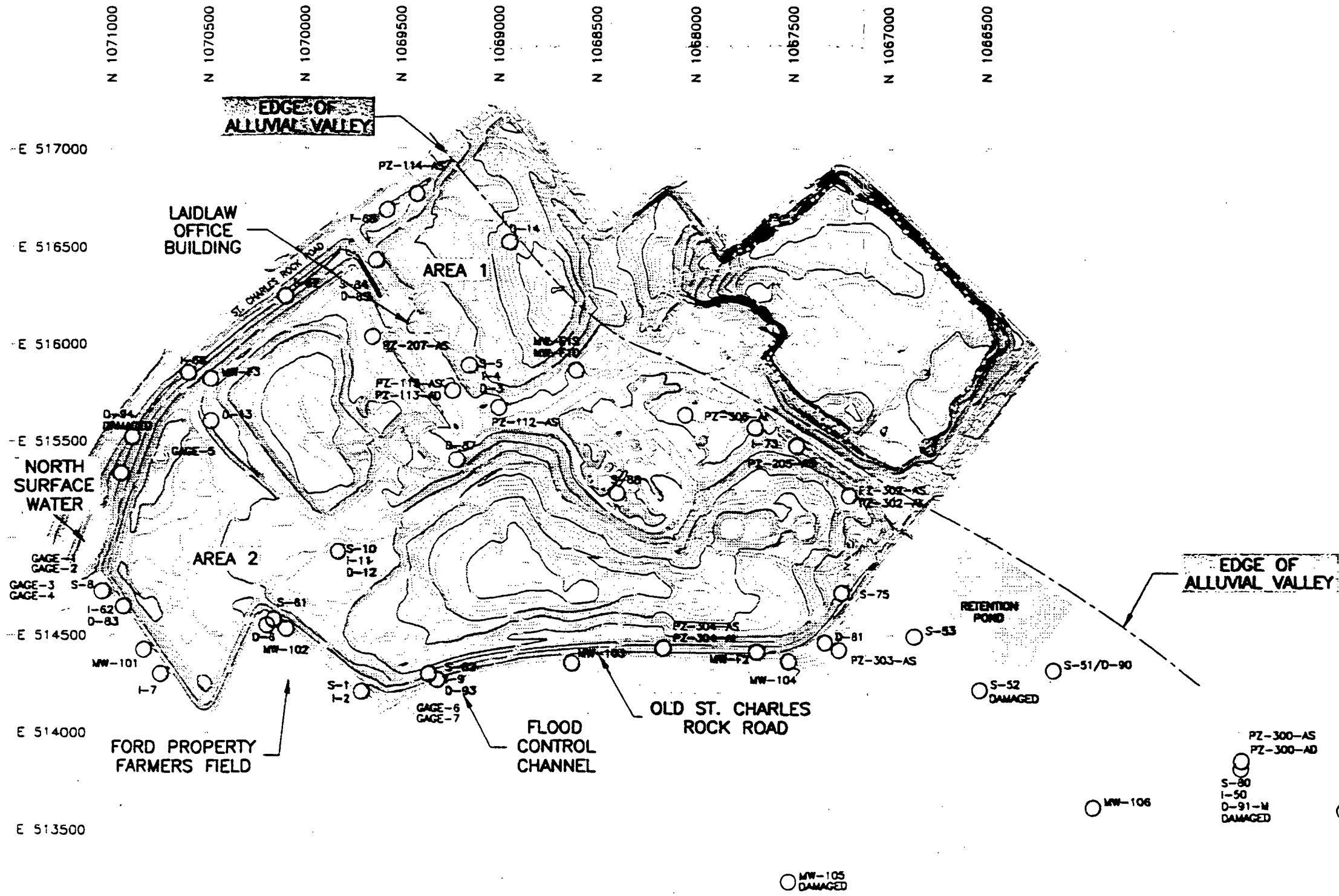
DUP (F) = Field duplicate

DUP (L) = Laboratory duplicate

MDA = Minimum Detectable Activity

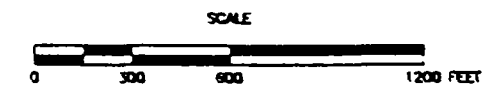
NE = Not established

Bolded numbers indicate result reported above minimum detectable activity



LEGEND

- S-1 ○ REMEDIAL INVESTIGATION MONITORING WELL LOCATION
MONITORING WELL LOCATION NUMBER
- PZ-113-AD ○ EXISTING MONITORING WELL LOCATION
LOCATION NUMBER
- GAGE-6 ○ STAFF GAGE LOCATION
STAFF GAGE LOCATION NUMBER
- AREAL EXTENT OF OVERLAND GAMMA SURVEY
- ELEVATION CONTOUR LINES
FEET MSL



REMEDIAL AND PREVIOUS INVESTIGATIONS
 MONITORING WELL LOCATION PLAN
 WEST LAKE LANDFILL
 BRIDGETON, MISSOURI



TABLE 2-11
THORIUM-232 DECAY SERIES (picocuries per liter [pCi/L]) - GROUNDWATER ANALYTICAL RESULTS
NOVEMBER 1995, FEBRUARY 1996, AND MAY 1996
METHODS NAS-NS-3004 AND EPA 901.1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Monitoring Well	Lead-212						Bismuth-212						Thallium-208					
	November 1995			February 1996			November 1995			February 1996			November 1995			February 1996		
	Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Filtered	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Shallow Depth Wells																		
S-1	< MDA	16.41	< MDA	152.1	< MDA	18.58	< MDA	100.1	< MDA	76.55	< MDA	83.36	< MDA	12.54	< MDA	10.83	< MDA	12.41
S-1 DUP (F)	-	-	-	-	< MDA	17.58	-	-	-	-	< MDA	74.3	-	-	-	-	9.80	8.74
S-5	< MDA	16.97	< MDA	18.47	< MDA	28.69	< MDA	86.38	< MDA	112.4	< MDA	147.0	< MDA	12.40	< MDA	14.27	< MDA	20.07
S-8	< MDA	30.49	< MDA	20.41	< MDA	17.79	< MDA	15.26	< MDA	117.2	< MDA	84.40	< MDA	23.67	< MDA	15.00	< MDA	11.80
S-10	< MDA	18.59	< MDA	17.81	< MDA	17.54	< MDA	106.9	< MDA	98.82	< MDA	98.77	< MDA	11.91	< MDA	15.15	< MDA	15.84
S-61	< MDA	18.72	< MDA	17.31	< MDA	17.19	< MDA	95.60	< MDA	88.83	< MDA	88.80	< MDA	14.26	< MDA	10.84	< MDA	12.99
S-80	< MDA	18.69	< MDA	17.87	< MDA	15.85	< MDA	96.42	< MDA	89.79	< MDA	92.29	< MDA	14.76	< MDA	15.78	< MDA	12.61
S-80 DUP (F)	-	-	-	-	< MDA	25.97	-	-	-	-	< MDA	112.5	-	-	-	-	< MDA	13.76
S-82	< MDA	14.71	< MDA	9.00	< MDA	25.72	< MDA	88.62	< MDA	40.27	< MDA	128.8	< MDA	10.54	< MDA	6.53	< MDA	18.98
S-84	< MDA	16.52	< MDA	12.49	< MDA	19.15	< MDA	93.65	< MDA	85.09	< MDA	78.44	< MDA	13.57	< MDA	11.31	< MDA	13.01
S-84 DUP (F)	< MDA	16.89	< MDA	18.78	-	-	< MDA	102.6	< MDA	68.22	-	-	< MDA	14.13	11.1	9.99	-	-
MW-101	< MDA	14.05	< MDA	15.12	< MDA	15.78	< MDA	90.96	< MDA	80.88	< MDA	89.76	< MDA	10.54	< MDA	11.23	< MDA	12.44
MW-107	< MDA	11.46	< MDA	10.38	< MDA	19.53	< MDA	48.11	< MDA	45.46	< MDA	103.0	< MDA	6.63	< MDA	6.43	< MDA	13.46
MW-107 DUP (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW-F3	< MDA	31.54	< MDA	18.26	< MDA	21.53	< MDA	172.3	< MDA	80.77	< MDA	80.54	< MDA	25.85	< MDA	13.45	< MDA	14.08
PZ-114-AS	< MDA	17.33	< MDA	14.40	< MDA	18.97	< MDA	74.16	< MDA	80.79	< MDA	117.3	< MDA	12.86	< MDA	10.26	< MDA	14.60
Intermediate Depth Wells																		
I-2	< MDA	10.63	< MDA	9.58	< MDA	17.96	< MDA	47.14	< MDA	47.73	< MDA	81.48	< MDA	67.62	< MDA	6.68	< MDA	14.15
I-4	< MDA	16.57	< MDA	28.47	< MDA	19.57	< MDA	73.97	< MDA	155.3	< MDA	101.8	< MDA	12.21	< MDA	18.69	< MDA	15.32
I-4 DUP (F)	< MDA	13.6	< MDA	18.99	-	-	< MDA	96.78	< MDA	78.42	-	-	11.92	10.13	< MDA	12.07	-	-
I-7	< MDA	28.96	< MDA	18.22	< MDA	29.51	< MDA	150.4	< MDA	79.76	< MDA	113.2	< MDA	19.58	< MDA	9.46	< MDA	18.89
I-9	< MDA	17.48	< MDA	8.57	< MDA	17.36	< MDA	90.82	< MDA	46.75	< MDA	101.5	< MDA	12.09	< MDA	6.30	< MDA	13.06
I-11	< MDA	18.48	< MDA	17.90	< MDA	15.90	< MDA	10.33	< MDA	111.3	< MDA	95.63	< MDA	13.50	< MDA	12.20	< MDA	11.14
I-62	< MDA	9.01	< MDA	9.93	< MDA	15.30	< MDA	95.13	< MDA	55.33	< MDA	87.44	< MDA	6.50	< MDA	6.30	< MDA	11.48
I-65	< MDA	15.48	< MDA	15.80	< MDA	18.63	< MDA	85.16	< MDA	57.82	< MDA	105.1	< MDA	12.50	< MDA	11.92	< MDA	12.88
I-66	< MDA	17.98	< MDA	18.94	< MDA	18.82	< MDA	101.4	< MDA	95.45	< MDA	88.17	< MDA	13.89	< MDA	13.78	< MDA	13.07
I-66 DUP (F)	-	-	-	-	< MDA	17.96	-	-	-	-	< MDA	82.43	-	-	-	-	< MDA	11.71
I-67	< MDA	19.17	< MDA	15.53	< MDA	20.25	< MDA	90.30	< MDA	72.87	< MDA	97.23	< MDA	12.14	< MDA	11.86	< MDA	13.92
I-68	< MDA	18.07	< MDA	17.80	< MDA	17.91	< MDA	103.0	< MDA	92.11	< MDA	94.11	< MDA	13.05	< MDA	13.86	< MDA	14.88
I-68 DUP (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deep Depth Wells																		
D-3	< MDA	12.33	< MDA	27.59	< MDA	15.30	< MDA	66.85	< MDA	131.1	< MDA	88.87	< MDA	10.80	< MDA	17.46	< MDA	8.08
D-3 DUP (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D-6	< MDA	16.06	< MDA	17.74	< MDA	21.72	< MDA	86.20	< MDA	86.50	< MDA	111.6	< MDA	12.51	< MDA	13.95	< MDA	11.31
D-12	< MDA	9.63	< MDA	9.45	< MDA	19.39	< MDA	56.47	< MDA	45.80	< MDA	120.2	< MDA	7.52	< MDA	6.85	< MDA	14.76
D-13	< MDA	16.98	< MDA	16.33	< MDA	16.64	< MDA	94.22	< MDA	77.42	< MDA	88.49	< MDA	12.74	< MDA	10.13	< MDA	12.45
D-14	< MDA	20.56	< MDA	19.51	< MDA	19.49	< MDA	102.2	< MDA	19.51	< MDA	83.93	< MDA	12.86	< MDA	12.27	< MDA	15.39
D-83	< MDA	18.49	< MDA	8.26	< MDA	17.05	< MDA	84.77	< MDA	18.24	< MDA	95.07	< MDA	12.63	< MDA	6.42	< MDA	14.49
D-85	< MDA	17.59	< MDA	18.78	< MDA	32.62	< MDA	84.95	< MDA	89.36	< MDA	167.5	< MDA	12.04	< MDA	14.19	< MDA	23.03
D-85 DUP (F)	< MDA	16.75	< MDA	18.35	-	-	< MDA	78.79	< MDA	100.3	-	-	< MDA	11.15	< MDA	13.86	-	-
D-93	< MDA	17.79	< MDA	16.34	< MDA	17.48	< MDA	99.16	< MDA	91.25	< MDA	82.58	< MDA	12.56	< MDA	15.53	< MDA	11.50
D-93 DUP (F)	-	-	-	-	< MDA	28.13	-	-	-	-	< MDA	148.1	-	-	-	-	< MDA	17.49

- = Not reported

xx = No tracer counts. Therefore, results could not be generated.

DUP (F) = Field duplicate

PZ-114-AS = Piezometer-114-Alluvial Shallow

Bolded numbers indicate result above the Minimum Detectable Activity

TABLE 2-11
THORIUM-232 DECAY SERIES (picocuries per liter [pCi/L]) - GROUNDWATER ANALYTICAL RESULTS
NOVEMBER 1995, FEBRUARY 1996, AND MAY 1996
METHODS NAS-NS-3004 AND EPA 901.1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Monitoring Well	Thorium-232										Radium-228					Thorium-232										Radium-228									
	November 1995				February 1996				May 1996		November 1995				February 1996		November 1995				February 1996				May 1996		November 1995				February 1996				
	Unfiltered		Filtered		Unfiltered		Filtered		Filtered	Unfiltered		Filtered		Filtered	Unfiltered		Filtered		Unfiltered		Filtered		Filtered	Unfiltered		Filtered		Filtered	Unfiltered		Filtered				
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA			
Shallow Depth Wells																																			
S-1	< MDA	0.47	< MDA	0.31	0.30	0.14	< MDA	0.11	< MDA	0.08	< MDA	50.89	< MDA	41.81	< MDA	38.10	5.98	0.58	6.21	0.36	< MDA	0.18	< MDA	0.14	< MDA	0.14	< MDA	186.3	< MDA	153.0	< MDA	218.4			
S-1 DUP (F)	-	-	-	-	0.14	0.12	-	-	-	-	-	-	-	-	< MDA	41.44	-	-	-	-	0.27	0.13	-	-	-	-	-	-	-	-	< MDA	150.3			
S-3	xx	-	< MDA	1.58	< MDA	0.24	< MDA	0.25	< MDA	0.10	< MDA	45.38	< MDA	47.04	< MDA	75.33	xx	-	< MDA	1.26	< MDA	0.29	< MDA	0.188	< MDA	0.12	< MDA	170.9	< MDA	207.8	< MDA	321.3			
S-8	< MDA	0.27	xx	-	0.50	0.21	< MDA	0.21	< MDA	0.07	< MDA	62.41	< MDA	54.23	< MDA	44.53	< MDA	0.49	xx	-	0.55	0.37	< MDA	0.17	< MDA	0.11	< MDA	35.28	< MDA	237.8	< MDA	180.4			
S-10	< MDA	2.91	< MDA	1.94	< MDA	10.2	< MDA	0.10	< MDA	0.20	< MDA	62.07	< MDA	56.00	< MDA	37.53	< MDA	4.68	< MDA	3.27	< MDA	10.2	< MDA	0.14	< MDA	0.15	< MDA	204.2	< MDA	214.3	< MDA	203.0			
S-61	< MDA	3.31	< MDA	0.41	< MDA	0.15	< MDA	0.16	0.06	0.06	< MDA	38.86	< MDA	43.27	< MDA	47.31	< MDA	0.34	< MDA	0.34	< MDA	0.19	< MDA	0.24	< MDA	0.18	< MDA	192.9	< MDA	194.9	< MDA	198.6			
S-80	< MDA	1.35	< MDA	0.38	3.73	0.17	< MDA	0.11	-	-	< MDA	45.10	< MDA	46.39	< MDA	46.43	< MDA	1.63	< MDA	0.61	4.06	0.24	< MDA	0.097	-	-	< MDA	202.3	< MDA	197.4	< MDA	204.7			
S-80 DUP (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< MDA	63.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< MDA	275			
S-82	< MDA	1.1	< MDA	0.62	0.22	0.20	< MDA	0.09	< MDA	0.19	< MDA	46.16	< MDA	22.42	< MDA	63.61	7.99	1.49	8.98	0.65	0.43	0.37	< MDA	0.14	< MDA	0.17	< MDA	133.0	< MDA	78.13	< MDA	290.8			
S-84	< MDA	0.76	< MDA	0.432	0.14	0.13	< MDA	0.12	< MDA	0.08	< MDA	50.95	< MDA	39.40	< MDA	34.28	< MDA	0.72	< MDA	0.500	< MDA	0.19	< MDA	0.12	< MDA	0.15	< MDA	184.3	< MDA	153.6	< MDA	194.3			
S-84 DUP (F)	-	-	-	-	-	-	-	-	-	-	< MDA	36.36	< MDA	43.12	-	-	-	-	-	-	-	-	-	-	-	-	-	< MDA	177.3	< MDA	205.9	-	-		
MW-101	< MDA	0.22	< MDA	0.34	< MDA	0.17	< MDA	0.11	< MDA	0.11	< MDA	41.24	< MDA	42.73	< MDA	45.04	< MDA	0.24	< MDA	0.48	< MDA	0.33	< MDA	0.15	< MDA	0.15	< MDA	138.3	< MDA	152.9	< MDA	174.9			
MW-107	1.05	0.34	< MDA	1.2	0.37	0.14	0.14	0.10	< MDA	0.16	< MDA	22.77	< MDA	22.37	< MDA	51.84	< MDA	0.53	< MDA	1.05	0.44	0.15	< MDA	0.14	< MDA	0.15	< MDA	108.3	< MDA	96.18	< MDA	198.0			
MW-107 DUP (F)	-	-	-	-	-	-	-	-	< MDA	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< MDA	0.20	-	-	-	-	-	-			
MW-F3	< MDA	4.64	< MDA	1.81	0.22	0.06	< MDA	0.10	< MDA	0.05	< MDA	81.01	< MDA	39.30	< MDA	40.71	8.23	4.43	8.33	5.37	0.31	0.13	< MDA	0.28	< MDA	0.13	< MDA	343.8	< MDA	190.0	< MDA	246.2			
PZ-114-AS	1.36	1.05	0.95	0.89	0.37	0.11	< MDA	0.10	< MDA	0.23	< MDA	40.94	< MDA	48.16	< MDA	57.36	< MDA	0.947	< MDA	0.930	0.25	0.18	< MDA	0.10	< MDA	0.21	< MDA	153.3	< MDA	132.6	< MDA	217.7			
Intermediate Depth Wells																																			
I-2	< MDA	0.33	< MDA	0.33	< MDA	0.10	< MDA	0.22	< MDA	0.07	< MDA	23.98	< MDA	21.88	< MDA	51.73	8.22	0.98	7.3	0.38	0.33	0.15	< MDA	0.21	< MDA	0.14	< MDA	118.9	< MDA	104.2	< MDA	196.7			
I-4	< MDA	1.06	< MDA	1.40	< MDA	0.10	0.13	0.12	< MDA	0.08	< MDA	43.31	< MDA	76.08	< MDA	51.23	< MDA	1.53	< MDA	1.26	0.35	0.19	< MDA	0.16	< MDA	0.11	< MDA	162.9	< MDA	322.0	< MDA	230.6			
I-4 DUP (F)	-	-	-	-	-	-	-	-	-	-	< MDA	44.77	< MDA	43.14	-	-	-	-	-	-	-	-	-	-	-	-	< MDA	191.4	< MDA	208.4	-	-			
I-7	0.24	0.13	< MDA	1.98	0.22	0.13	< MDA	0.16	< MDA	0.16	< MDA	64.10	< MDA	33.42	< MDA	70.51	< MDA	0.171	< MDA	2.34	< MDA	0.22	< MDA	0.15	< MDA	0.16	< MDA	324.4	< MDA	193.9	< MDA	337.0			
I-9	< MDA	0.6	< MDA	0.74	< MDA	0.24	< MDA	0.10	< MDA	0.20	< MDA	42.95	< MDA	21.59	< MDA	45.77	7.29	0.9	8.01	0.86	0.24	0.19	< MDA	0.14	< MDA	0.15	< MDA	199.0	< MDA	83.09	< MDA	189.4			
I-11	< MDA	2.44	< MDA	0.49	< MDA	0.14	< MDA	0.10	< MDA	0.14	< MDA	48.54	< MDA	47.45	< MDA	42.60	< MDA	0.42	< MDA	0.7	0.21	0.17	< MDA	0.14	< MDA	0.10	< MDA	213.5	< MDA	179.8	< MDA	142.8			
I-62	< MDA	0.32	< MDA	0.41	< MDA	0.28	< MDA	0.23	< MDA	0.13	< MDA	22.21	< MDA	26.73	< MDA	35.31	< MDA	0.47	< MDA	0.52	< MDA	0.39	< MDA	0.19	< MDA	0.15	< MDA	74.26	< MDA	109.1	< MDA	148.0			
I-65	< MDA	0.51	< MDA	0.20	< MDA	0.16	< MDA	0.10	< MDA	0.10	< MDA	39.23	< MDA	37.29	< MDA	48.27	< MDA	0.409	< MDA	0.328	< MDA	0.21	< MDA	0.15	< MDA	0.13	< MDA	137.9	< MDA	154.6	< MDA	215.4			
I-66	< MDA	2.24	< MDA	1.96	< MDA	0.67	< MDA	0.11	< MDA	0.28	< MDA	41.27	< MDA	51.48	< MDA	46.52	< MDA	2.07	< MDA	1.84	< MDA	0.57	< MDA	0.16	< MDA	0.35	< MDA	188.7	< MDA	206.5	< MDA	197.2			
I-66 DUP (F)	-	-	-	-	< MDA	0.25	< MDA	0.09	-	-	-	-	-	-	< MDA	45.78	-	-	-	< MDA	0.17	< MDA	0.14	-	-	-	-	-	-	-	< MDA	177.0			
I-67	< MDA	0.50	< MDA	1.29	< MDA	0.26	< MDA	0.10	< MDA	0.08	< MDA	37.40	< MDA	45.78	< MDA	32.33	< MDA	0.80	< MDA	1.72	< MDA	0.26	< MDA	0.14	< MDA	0.15	< MDA	214.4	< MDA	182.0	< MDA	229.3			
I-68	< MDA	0.514	< MDA	0.736	< MDA	0.14	< MDA	0.13	< MDA	0.16	< MDA	47.73	< MDA	46.86	< MDA	51.01	< MDA	0.627	< MDA	0.910	< MDA	0.15	< MDA	0.19	< MDA	0.17	< MDA	202.7	< MDA	194.2	< MDA	198.6			
I-68 DUP (F)	-	-	-	-	-	-	-	-	< MDA	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< MDA	0.14	-	-	-	-	-	-			
Deep Depth Wells																																			
D-3	< MDA	0.10	< MDA	0.60	< MDA	0.09	< MDA	0.22	< MDA	0.09	< MDA	51.73	< MDA	67.18	< MDA	42.02	< MDA	0.56	< MDA	0.71	0.22	0.12	< MDA	0.22	< MDA	0.14	< MDA	148.4	< MDA	30.52	< MDA	146.0			
D-3 DUP (F)	-	-	-	-	-	-	-	-	< MDA	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12	0.12	-	-	-	-	-	-			
D-6	< MDA	0.3	< MDA	0.239	< MDA	0.13	< MDA	0.12	< MDA	0.10	< MDA	47.22	< MDA	43.52	< MDA	48.98	< MDA	0.35	< MDA	0.494	0.23	0.18	0.16	0.15	< MDA	0.14	< MDA	171.5	< MDA	194.1	< MDA	240.1			
D-12	< MDA	2.36	< MDA	0.52	< MDA	0.12	1.25	0.42	< MDA	0.11	< MDA	27.63	< MDA	24.51	< MDA	53.45	< MDA	2.56	< MDA	0.63	< MDA	0.13	< MDA	0.34	< MDA	0.13	< MDA	102.1	< MDA	103.5	< MDA	216.8			
D-13	< MDA	2.11	< MDA	1.79	0.11	0.08	< MDA	0.08	< MDA	0.07	< MDA	53.85	< MDA	40.97	< MDA	48.24	9.31	3.44	6.06	1.42	0.14	0.08	< MDA	0.098	< MDA	0.10	< MDA	190.7	< MDA	125.0	< MDA	187.7			
D-14	< MDA	0.35	< MDA	1.96	0.38	0.15	< MDA	0.22	-	-	< MDA	47.81	< MDA	51.91	< MDA	43.37	< MDA	0.58	< MDA	1.82	0.31	0.20	< MDA	0.19	-	-	< MDA	290.0	< MDA	188.0	< MDA	246.8			
D-83	0.																																		

TABLE 2-10
URANIUM-235 DECAY SERIES (picocuries per liter (pCi/L)) - GROUNDWATER ANALYTICAL RESULTS
NOVEMBER 1995 AND FEBRUARY 1996
METHODS NAS-NS-0650 and EPA 901.1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Monitoring Well	Uranium-235/236						Uranium-235						Protactinium-231						Actinium-227						Radium-226					
	November 1995			February 1996			November 1995			February 1996			November 1995			February 1996			November 1995			February 1996			November 1995			February 1996		
	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered	Unfiltered		Filtered
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Shallow Depth Wells																														
S-1	0.57	0.2	0.71	0.34	0.38	0.23	< MDA	56.75	< MDA	43.90	< MDA	71.65	< MDA	289	< MDA	242	< MDA	331	< MDA	58.4	< MDA	47.0	< MDA	66.4	< MDA	683.2	< MDA	567.1	< MDA	759.5
S-1 DUP (F)	-	-	-	-	-	-	-	-	-	-	< MDA	63.72	-	-	-	-	< MDA	312	-	-	-	-	< MDA	54.1	-	-	-	-	< MDA	706
S-5	< MDA	0.33	< MDA	0.39	< MDA	0.191	< MDA	44.64	< MDA	39.82	< MDA	118.4	< MDA	284	< MDA	313	< MDA	543	< MDA	50	< MDA	64.2	< MDA	110	< MDA	269.8	< MDA	350.1	< MDA	479.7
S-8	< MDA	0.32	< MDA	0.46	< MDA	0.206	< MDA	127.8	< MDA	60.68	< MDA	39.49	< MDA	563	< MDA	364	< MDA	287	< MDA	118	< MDA	63.4	< MDA	50.6	< MDA	561.5	< MDA	324.8	< MDA	770.33
S-10	1.18	0.26	< MDA	0.56	< MDA	0.33	< MDA	33.33	< MDA	60.23	< MDA	55.66	< MDA	353	< MDA	379	< MDA	333	< MDA	62.3	< MDA	64.4	< MDA	58.6	< MDA	321.6	< MDA	300.7	< MDA	378.8
S-61	0.31	0.16	0.33	0.2	0.37	0.17	< MDA	50.15	< MDA	49.81	< MDA	73.64	< MDA	337	< MDA	286	< MDA	326	< MDA	58.4	< MDA	55.8	< MDA	63	< MDA	514.1	< MDA	489.9	< MDA	350.6
S-80	0.28	0.17	0.4	0.28	0.28	0.26	< MDA	60.62	< MDA	48.80	< MDA	49.66	< MDA	333	< MDA	349	< MDA	258	< MDA	65.9	< MDA	53.5	< MDA	54.6	< MDA	449.1	< MDA	453.1	< MDA	320.2
S-80 DUP (F)	-	-	-	-	-	-	-	-	-	-	< MDA	87.47	-	-	-	-	< MDA	420	-	-	-	-	< MDA	82.6	-	-	-	-	< MDA	944.6
S-82	0.82	0.29	0.43	0.31	< MDA	0.24	< MDA	40.38	< MDA	23.51	< MDA	106.3	< MDA	255	< MDA	136	< MDA	482	< MDA	45.8	< MDA	25.1	< MDA	94.7	< MDA	556.7	< MDA	306.7	< MDA	515.3
S-84	< MDA	0.334	< MDA	0.165	< MDA	0.48	< MDA	57.00	< MDA	40.25	< MDA	64.21	< MDA	341	< MDA	260	< MDA	282	< MDA	63.8	< MDA	46.7	< MDA	61.3	< MDA	664.8	< MDA	544.4	< MDA	348.4
S-84 DUP (F)	-	-	-	-	-	-	< MDA	49.0	< MDA	68.47	-	-	< MDA	338	< MDA	314	-	-	< MDA	57.9	< MDA	71.0	-	-	< MDA	752.6	< MDA	768.3	-	-
MW-101	0.56	0.48	< MDA	1.63	< MDA	0.21	< MDA	42.47	< MDA	43.23	< MDA	46.50	< MDA	270	< MDA	242	< MDA	256	< MDA	46.6	< MDA	47.6	< MDA	51.1	< MDA	376.9	< MDA	428.0	< MDA	619.9
MW-107	< MDA	1.2	0.5	0.36	< MDA	0.163	< MDA	40.43	< MDA	38.12	< MDA	67.86	< MDA	184	< MDA	160	< MDA	185	< MDA	39.6	< MDA	34.3	< MDA	69.2	< MDA	237.2	< MDA	207.1	< MDA	438.1
MW-F3	< MDA	0.56	< MDA	0.35	< MDA	0.48	< MDA	128.2	< MDA	60.71	< MDA	75.09	< MDA	602	< MDA	294	< MDA	308	< MDA	125	< MDA	60.2	< MDA	72.8	< MDA	933.4	< MDA	439.1	< MDA	380.3
PZ-114-AS	< MDA	0.153	0.14	0.14	< MDA	0.25	< MDA	40.77	< MDA	41.31	< MDA	52.37	< MDA	233	< MDA	248	< MDA	336	< MDA	41.9	< MDA	42.2	< MDA	67	< MDA	566.0	< MDA	523.4	< MDA	372.8
Intermediate Depth Wells																														
I-2	< MDA	0.48	0.91	0.28	< MDA	0.26	< MDA	34.97	< MDA	34.44	< MDA	53.37	< MDA	166	< MDA	161	< MDA	391	< MDA	36.0	< MDA	31.2	< MDA	59.7	< MDA	374.1	< MDA	341.3	< MDA	379.2
I-4	< MDA	0.167	< MDA	0.283	< MDA	0.062	< MDA	41.66	< MDA	116.7	< MDA	61.32	< MDA	251	< MDA	336	< MDA	368	< MDA	48.3	< MDA	108	< MDA	69.1	< MDA	538.1	< MDA	113.9	< MDA	305.9
I-4 DUP (F)	-	-	-	-	-	-	56.48	54.14	< MDA	60.6	-	-	< MDA	290	< MDA	327	-	-	< MDA	53.6	< MDA	68.0	-	-	< MDA	701.8	< MDA	737.5	-	-
I-7	0.75	0.23	< MDA	0.47	0.33	0.18	< MDA	119.8	< MDA	66.05	< MDA	120.2	< MDA	346	< MDA	290	< MDA	520	< MDA	113	< MDA	61.4	< MDA	110	< MDA	340.8	< MDA	436.4	< MDA	139.2
I-9	0.33	0.23	0.85	0.24	0.24	0.22	< MDA	75.67	< MDA	22.35	< MDA	33.89	< MDA	335	< MDA	133	< MDA	310	< MDA	67.0	< MDA	28.3	< MDA	56.3	< MDA	692.4	< MDA	284.1	< MDA	371.0
I-11	0.39	0.29	< MDA	0.25	< MDA	0.37	< MDA	56.70	< MDA	50.70	< MDA	45.84	< MDA	298	< MDA	289	< MDA	262	< MDA	69.3	< MDA	61.2	< MDA	40.4	< MDA	442.0	< MDA	397.9	< MDA	278.7
I-62	< MDA	0.47	< MDA	0.64	< MDA	0.381	< MDA	20.34	< MDA	32.00	< MDA	42.74	< MDA	142	< MDA	186	< MDA	244	< MDA	24.6	< MDA	55.9	< MDA	45.1	< MDA	187.2	< MDA	243.8	< MDA	290.6
I-65	< MDA	0.35	< MDA	0.16	0.053	0.028	< MDA	44.32	< MDA	39.84	< MDA	51.03	< MDA	232	< MDA	241	< MDA	326	< MDA	42.2	< MDA	47.7	< MDA	62.8	< MDA	488.7	< MDA	464.3	< MDA	326.2
I-66	0.57	0.20	0.10	0.34	0.060	0.037	< MDA	52.99	< MDA	53.46	< MDA	58.84	< MDA	281	< MDA	326	< MDA	337	< MDA	56.1	< MDA	62.4	< MDA	59.5	< MDA	556.9	< MDA	615.5	< MDA	275.0
I-66 DUP (F)	-	-	-	-	1.67	0.20	-	-	-	-	< MDA	47.09	-	-	-	-	< MDA	261	-	-	-	-	< MDA	48.1	-	-	-	-	< MDA	270.8
I-67	< MDA	0.207	< MDA	0.245	0.08	0.040	< MDA	66.19	< MDA	50.13	< MDA	60.54	< MDA	303	< MDA	276	< MDA	319	< MDA	68.6	< MDA	54.0	< MDA	68.7	< MDA	636.9	< MDA	526.8	< MDA	378.8
I-68	< MDA	0.22	< MDA	0.159	< MDA	0.147	< MDA	56.01	< MDA	54.69	< MDA	59.32	< MDA	314	< MDA	292	< MDA	344	< MDA	62.1	< MDA	55.4	< MDA	60.8	< MDA	776.8	< MDA	725.1	< MDA	346.2
Deep Depth Wells																														
D-3	< MDA	0.18	< MDA	0.21	< MDA	0.107	< MDA	40.80	< MDA	105.8	< MDA	44.72	< MDA	234	< MDA	490	< MDA	252	< MDA	44.4	< MDA	39.6	< MDA	43.6	< MDA	610.2	< MDA	112.0	< MDA	221.4
D-6	< MDA	0.46	0.29	0.27	< MDA	0.26	< MDA	52.89	< MDA	57.74	< MDA	62.31	< MDA	282	< MDA	320	< MDA	359	< MDA	53.7	< MDA	59.5	< MDA	78.6	< MDA	456.2	< MDA	516.1	< MDA	968.3
D-12	< MDA	0.31	< MDA	0.3	< MDA	0.180	< MDA	20.07	< MDA	28.20	< MDA	59.37	< MDA	176	< MDA	164	< MDA	324	< MDA	31.2	< MDA	31.2	< MDA	64.3	< MDA	230.1	< MDA	210.9	< MDA	384.6
D-13	< MDA	1.51	< MDA	0.24	< MDA	0.22	< MDA	58.25	< MDA	42.82	< MDA	56.08	< MDA	324	< MDA	270	< MDA	294	< MDA	60.9	< MDA	45.5	< MDA	58.6	< MDA	483.2	< MDA	358.6	< MDA	317.9
D-14	0.88	0.3	0.2	0.15	< MDA	0.102	< MDA	65.63	< MDA	47.36	< MDA	71.79	< MDA	332	< MDA	309	< MDA	315	< MDA	65.5	< MDA	53.4	< MDA	65.6	< MDA	282.8	< MDA	265.7	< MDA	271.0
D-83	< MDA	0.49	< MDA	0.31	< MDA	0.30	< MDA	73.92	< MDA	22.81	< MDA	58.40	< MDA	341	< MDA	134	< MDA	343	< MDA	40.3	< MDA	25.2	< MDA	63.5	< MDA	468.6	< MDA	197.2	< MDA	397.1
D-85	0.39	0.24	< MDA	0.39	< MDA	0.46	< MDA	50.08	< MDA	57.02	< MDA	132.8	< MDA	316	< MDA	326	< MDA	616	< MDA	57.2	< MDA	63.4	< MDA	121	< MDA	626.9	< MDA	776.0	< MDA	676.8
D-85 DUP (F)	-	-	-	-	-	-	< MDA	43.45	< MDA	50.48	-	-	< MDA	260	< MDA	305	-	-	< MDA	42.2	< MDA	56.7	-	-	< MDA	586	< MDA	633.9	-	-
D-93	< MDA	0.4	< MDA	0.14	< MDA	0.23	< MDA	50.15	< MDA	55.04	< MDA	66.79	< MDA	315	< MDA	310	< MDA	306	< MDA	52.3	< MDA	56.8	< MDA	61.4	< MDA	637.8	< MDA	595.2	< MDA	317.2
D-93 DUP (F)	-	-	-	-	< MDA	0.18	-	-	-	-	< MDA	11.78	-	-	-	-	< MDA	532	-	-	-	-	< MDA	105	-	-	-	-	< MDA	681.9

-- = Not reported

TABLE 2-9
URANIUM -238 DECAY SERIES (picocuries per liter (pCi/L)) - GROUNDWATER ANALYTICAL RESULTS
NOVEMBER 1995, FEBRUARY 1996, AND MAY 1996
METHODS NAS-NS-3050, NAS-NS-3004, EPA 903.0 AND EPA 901.1
WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Monitoring Well	Radium-226												Lead-214						Bismuth-214						Lead-210						
	November 1995				February 1996				May 1996				November 1995			February 1996			November 1995			February 1996			November 1995			February 1996			
	EPA 901.1				EPA 903.0		EPA 901.1		EPA 903.0				EPA 901.1						EPA 901.1						EPA 901.1						
	Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Filtered		
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	
Shallow Depth Wells																															
S-1	< MDA	29.4	< MDA	20.7	0.52	0.42	< MDA	33.0	0.43	0.10	0.10	0.08	< MDA	29.95	< MDA	18.63	< MDA	26.75	< MDA	29.59	< MDA	20.67	< MDA	32.98	< MDA	172	< MDA	108	< MDA	1290	
S-1 DUP (F)	-	-	-	-	0.51	0.07	28.6	17.7	-	-	-	-	-	-	-	-	26.02	23.91	-	-	-	-	< MDA	27.52	-	-	-	-	< MDA	299	
S-5	< MDA	31.5	< MDA	32.5	0.60	0.24	< MDA	41.7	0.23	0.10	< MDA	0.13	< MDA	27.28	< MDA	30.55	< MDA	39.66	< MDA	31.49	< MDA	32.50	< MDA	41.66	< MDA	118	< MDA	209	< MDA	3960	
S-8	< MDA	37.8	< MDA	35.7	0.91	0.34	< MDA	32.2	0.37	0.17	0.21	0.13	< MDA	43.15	< MDA	31.15	< MDA	23.69	< MDA	37.81	< MDA	35.74	< MDA	32.19	< MDA	3680	< MDA	222	< MDA	163	
S-10	< MDA	38.8	< MDA	35.5	< MDA	0.37	< MDA	29.2	0.34	0.14	0.32	0.32	< MDA	38.89	56.7	22.3	< MDA	28.91	< MDA	38.77	< MDA	35.49	< MDA	29.24	< MDA	211	< MDA	221	< MDA	191	
S-61	< MDA	30.6	< MDA	25.7	0.71	0.28	< MDA	28.0	0.29	0.10	0.29	0.12	< MDA	26.53	< MDA	22.43	< MDA	24.81	< MDA	30.61	< MDA	25.67	< MDA	28.02	< MDA	152	< MDA	145	< MDA	332	
S-80	< MDA	31.5	34.9	24.5	3.38	0.16	130	21	-	-	-	-	< MDA	26.88	34.0	20.4	125	17	< MDA	31.30	< MDA	39.54	< MDA	51.57	< MDA	186	< MDA	165	< MDA	163	
S-80 DUP (F)	-	-	-	-	-	-	< MDA	31.0	-	-	-	-	-	-	-	-	< MDA	29.82	-	-	-	-	< MDA	30.98	-	-	-	-	< MDA	429	
S-82	< MDA	22.1	< MDA	12.8	1.09	0.40	< MDA	39.2	1.59	0.18	0.88	0.09	< MDA	19.25	< MDA	11.16	< MDA	35.24	< MDA	25.09	< MDA	12.78	< MDA	39.23	< MDA	143	< MDA	57.2	< MDA	3660	
S-84	< MDA	30.5	< MDA	28.8	0.64	0.25	< MDA	28.7	0.34	0.09	0.34	0.21	< MDA	25.03	< MDA	22.35	< MDA	23.97	< MDA	30.28	< MDA	28.81	< MDA	28.67	< MDA	181	< MDA	136	< MDA	309	
S-84 DUP (F)	< MDA	33.5	< MDA	23.2	-	-	-	-	-	-	-	-	< MDA	25.98	< MDA	22.21	-	-	< MDA	33.5	< MDA	23.19	-	-	< MDA	196	< MDA	1300	-	-	
MW-101	< MDA	27.3	< MDA	26.2	0.49	0.34	< MDA	34.7	0.18	0.10	0.22	0.08	< MDA	20.49	< MDA	20.46	25.6	16.9	< MDA	27.28	< MDA	26.19	< MDA	34.66	156	100	< MDA	137	< MDA	118	
MW-107	36.8	9.9	33.7	11.4	0.78	0.21	< MDA	50.8	0.56	0.12	< MDA	0.09	36.1	11.6	39.2	11.0	83.7	26.2	< MDA	19.47	< MDA	18.20	< MDA	50.80	< MDA	432	< MDA	174	< MDA	231	
MW-107 DUP (F)	-	-	-	-	-	-	-	-	0.71	0.12	< MDA	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
MW-F3	< MDA	34.0	< MDA	23.4	1.05	0.30	< MDA	33.3	0.44	0.14	0.50	0.08	< MDA	42.93	< MDA	23.87	< MDA	31.52	< MDA	33.98	< MDA	23.36	< MDA	33.33	< MDA	5570	< MDA	301	< MDA	1380	
PZ-114-AS	< MDA	27.2	< MDA	24.6	0.68	0.24	< MDA	35.8	0.17	0.17	0.51	0.22	< MDA	23.29	< MDA	18.48	< MDA	33.56	< MDA	27.23	< MDA	24.62	< MDA	15.75	< MDA	137	< MDA	104	< MDA	176	
Intermediate Depth Wells																															
I-2	< MDA	13.6	< MDA	12.9	1.69	0.28	< MDA	36.6	1.44	0.15	1.17	0.11	< MDA	13.19	< MDA	11.80	< MDA	30.65	< MDA	13.55	< MDA	12.88	< MDA	36.61	< MDA	433	< MDA	172	< MDA	202	
I-4	< MDA	25.4	< MDA	41.4	2.41	0.18	< MDA	37.8	1.50	0.14	0.87	0.27	< MDA	22.05	< MDA	36.26	< MDA	32.33	< MDA	25.39	< MDA	41.35	< MDA	37.84	< MDA	132	< MDA	3070	< MDA	214	
I-4 DUP (F)	< MDA	29.6	< MDA	28.3	-	-	-	-	-	-	-	-	< MDA	25.38	< MDA	26.9	-	-	< MDA	29.65	< MDA	28.28	-	-	< MDA	141	< MDA	1300	-	-	
I-7	< MDA	42.7	< MDA	24.7	0.69	0.31	< MDA	47.8	0.35	0.18	0.18	0.11	< MDA	38.33	< MDA	20.34	< MDA	38.25	< MDA	42.70	< MDA	24.70	< MDA	47.77	< MDA	3420	< MDA	274	< MDA	4180	
I-9	< MDA	25.1	< MDA	12.7	1.08	0.35	< MDA	31.1	0.64	0.10	0.54	0.09	< MDA	23.30	< MDA	11.12	< MDA	26.55	< MDA	25.14	< MDA	12.72	< MDA	31.13	< MDA	2080	< MDA	54.5	< MDA	187	
I-11	< MDA	34.9	< MDA	25.5	0.85	0.30	< MDA	28.3	0.59	0.14	0.50	0.11	< MDA	30.59	< MDA	25.62	< MDA	23.38	< MDA	34.90	< MDA	25.46	< MDA	28.31	< MDA	213	< MDA	190	< MDA	145	
I-62	< MDA	14.2	< MDA	17.1	0.37	0.34	< MDA	26.6	0.35	0.11	< MDA	0.14	< MDA	12.16	< MDA	14.50	< MDA	16.80	< MDA	14.17	< MDA	17.06	< MDA	26.58	< MDA	58.7	< MDA	114	144	99	
I-65	< MDA	24.6	< MDA	23.3	0.79	0.26	< MDA	41.5	< MDA	0.15	< MDA	0.44	< MDA	20.90	< MDA	19.60	< MDA	37.04	< MDA	24.59	< MDA	23.32	< MDA	41.48	< MDA	109	< MDA	133	< MDA	205	
I-66	< MDA	28.2	< MDA	31.5	0.57	0.38	< MDA	33.6	< MDA	0.18	< MDA	0.34	< MDA	24.82	< MDA	24.85	37.3	21.5	< MDA	28.17	< MDA	31.27	< MDA	33.63	< MDA	186	< MDA	179	< MDA	161	
I-66 DUP (F)	-	-	-	-	0.48	0.24	< MDA	35.5	-	-	-	-	-	-	-	-	35.8	19.6	-	-	-	-	< MDA	35.51	-	-	-	-	< MDA	142	
I-67	< MDA	28.5	< MDA	23.9	0.54	0.23	< MDA	42.0	0.22	0.11	0.52	0.24	< MDA	24.51	< MDA	22.04	< MDA	36.11	< MDA	28.46	< MDA	23.85	< MDA	41.98	< MDA	1300	< MDA	144	< MDA	228	
I-68	< MDA	27.7	< MDA	28.6	0.72	0.16	< MDA	36.5	0.66	0.12	0.44	0.26	< MDA	24.57	< MDA	22.39	< MDA	29.87	101	98	< MDA	28.61	< MDA	36.52	< MDA	199	< MDA	177	< MDA	158	
I-68 DUP (F)	-	-	-	-	-	-	-	-	0.60	0.12	0.47	0.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Deep Depth Wells																															
D-3	< MDA	28.1	< MDA	39.8	2.7	0.28	< MDA	27.2	1.19	0.09	0.78	0.13	< MDA	20.40	< MDA	36.53	< MDA	18.25	< MDA	28.07	< MDA	39.85	< MDA	27.24	< MDA	101	< MDA	2940	< MDA	106	
D-3 DUP (F)	-	-	-	-	-	-	-	-	1.21	0.11	1.17	0.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
D-6	< MDA	28.2	< MDA	28.6	1.78	0.29	< MDA	36.7	1.88	0.09	1.66	0.10	< MDA	24.51	< MDA	25.69	< MDA	28.75	< MDA	28.25	< MDA	28.65	< MDA	36.69	< MDA	149	< MDA	186	< MDA	227	
D-12	< MDA	16.1	< MDA	15.4	0.50	0.32	< MDA	44.7	0.73	0.16	0.36	0.15	< MDA	14.06	< MDA	12.80	33.6	28.8	114	92	< MDA	15.40	< MDA	44.67	< MDA	109	< MDA	75.8	< MDA	166	
D-13	< MDA	30.2	< MDA	23.9	1.33	0.25	< MDA	24.6	0.86	0.12	0.58	0.15	< MDA	25.78	< MDA	21.67	< MDA	24.26	< MDA	30.25	< MDA	23.89	< MDA	24.60	< MDA	194	< MDA	133	< MDA	135	
D-14	69.8	23.4	< MDA	31.3	1.50	0.13	96.7	19.3	-	-	-	-	71	22.7	30.6	18.2	91.8	20.3	69.4	23.4	< MDA	31.33	< MDA	42.04	< MDA	324	< MDA	132	< MDA	323	
D-83	< MDA	25.8	< MDA	14.0	1.25	0.36	< MDA	30.5	0.81	0.13	0.82	0.14	< MDA	23.92	< MDA	10.82	< MDA	28.21	< MDA	25.75	< MDA	13.96	< MDA	30.46	< MDA	2100	< MDA	81.3	< MDA	222	
D-85	< MDA	25.9	< MDA	31.4	0.58	0.29	< MDA	34.4	0.16	0.15	0.54	0.25	< MDA	22.54	<																

TABLE 2-9
 URANIUM-238 DECAY SERIES (picocuries per liter [pCi/L]) - GROUNDWATER ANALYTICAL RESULTS
 NOVEMBER 1995, FEBRUARY 1996, AND MAY 1996
 METHODS NAS-NS-3050, NAS-NS-3004, EPA 903.0 AND EPA 901.1
 WEST LAKE LANDFILL, BRIDGETON, MISSOURI

Monitoring Well	Uranium-238						Thorium-234						Uranium-234						Thorium-230									
	November 1995			February 1996			November 1995			February 1996			November 1995			February 1996			November 1995			February 1996			May 1996			
	NAS-NS-3050						EPA 901.1						NAS-NS-3050						NAS-NS-3004									
	Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Filtered	
	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA	Result	MDA
Shadow Depth Wells																												
S-1	2.7	0.19	2.25	0.27	1.95	0.14	< MDA	145.2	< MDA	71.65	< MDA	240.7	2.97	0.26	3.35	0.27	3.35	0.21	< MDA	0.64	1.19	0.42	0.96	0.18	0.29	0.13	0.39	0.09
S-1 DUP (F)	-	-	-	-	-	-	-	-	-	-	< MDA	187	-	-	-	-	-	-	-	-	-	0.72	0.11	-	-	-	-	-
S-5	0.35	0.33	< MDA	0.35	< MDA	0.117	< MDA	103.6	178	107	< MDA	344.4	0.63	0.33	0.58	0.43	0.20	0.18	xx	-	2.79	1.91	1.76	0.23	0.58	0.256	< MDA	0.13
S-8	1.7	0.21	1.28	0.34	1.08	0.24	< MDA	343.3	< MDA	112.0	< MDA	78.92	2.01	0.27	1.69	0.27	1.47	0.29	0.53	0.51	xx	-	1.58	0.32	0.48	0.22	0.27	0.08
S-10	0.95	0.22	1.08	0.37	0.76	0.26	< MDA	98.05	< MDA	157.1	< MDA	103.3	1.28	0.27	1.31	0.43	1.14	0.30	< MDA	1.73	< MDA	6.7	< MDA	13.7	0.46	0.15	0.44	0.17
S-61	0.76	0.12	0.62	0.15	0.90	0.16	< MDA	139.4	< MDA	143.6	< MDA	201.4	1.12	0.18	1.51	0.21	1.36	0.22	2.3	0.44	1.62	0.55	0.97	0.18	1.39	0.23	0.49	0.12
S-80	1.69	0.15	0.49	0.19	0.85	0.21	< MDA	152.3	< MDA	145.5	< MDA	143.5	2.72	0.24	0.88	0.28	0.73	0.22	< MDA	2.09	0.61	0.59	5.29	0.20	0.38	0.14	-	-
S-80 DUP (F)	-	-	-	-	-	-	-	-	-	-	< MDA	258.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S-82	2.49	0.23	3.11	0.24	1.86	0.15	< MDA	75.49	< MDA	73.47	< MDA	306.1	4.48	0.31	5.17	0.28	2.51	0.23	< MDA	1.91	1.04	0.94	0.76	0.29	0.93	0.13	0.25	0.23
S-84	0.36	0.20	0.41	0.14	0.63	0.42	< MDA	146.5	< MDA	129.4	< MDA	189.2	0.55	0.22	0.22	0.18	0.50	0.41	1.31	1.08	< MDA	0.65	0.77	0.20	0.37	0.14	0.35	0.11
S-84 DUP (F)	-	-	-	-	-	-	< MDA	146.9	< MDA	228.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW-101	1.41	0.39	1.58	1.25	0.95	0.15	< MDA	75.49	< MDA	131.1	< MDA	77.63	1.43	0.36	3.92	1.2	1.69	0.19	0.49	0.33	0.96	0.45	0.69	0.29	< MDA	0.15	0.15	0.14
MW-107	< MDA	0.99	0.68	0.33	0.24	0.12	< MDA	136.7	< MDA	109.3	< MDA	162.1	< MDA	1.12	1.03	0.33	0.18	0.16	1.61	0.52	2.63	1.34	0.60	0.21	0.77	0.14	< MDA	0.19
MW-107 DUP (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< MDA	0.26
MW-F3	1.79	0.34	< MDA	0.28	< MDA	0.31	< MDA	360.8	< MDA	195.9	< MDA	259.1	2.03	0.55	0.41	0.33	0.78	0.40	< MDA	6.28	< MDA	6.6	1.81	0.09	0.54	0.17	< MDA	0.11
PZ-114-AS	2.81	0.12	2.44	0.11	2.08	0.16	< MDA	73.95	< MDA	76.03	< MDA	151.8	3.45	0.16	2.86	0.18	2.25	0.14	2.30	2.10	2.67	1.34	1.35	0.18	0.52	0.18	0.69	0.27
Intermediate Depth Wells																												
I-2	2.11	0.31	1.62	0.23	0.55	0.22	< MDA	131.0	< MDA	108.1	< MDA	155.4	2.87	0.31	3.27	0.26	0.89	0.21	1.04	1.03	< MDA	0.49	0.34	0.12	0.40	0.25	0.31	0.09
I-4	< MDA	0.14	< MDA	0.17	0.12	0.03	< MDA	66.91	< MDA	300.9	< MDA	155.6	< MDA	0.18	0.22	0.16	0.17	0.06	< MDA	1.84	< MDA	2.04	0.64	0.10	0.64	0.17	0.65	0.11
I-4 DUP (F)	-	-	-	-	-	-	< MDA	140.4	< MDA	221.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I-7	3.62	0.21	1.92	0.31	1.51	0.13	< MDA	310.1	< MDA	187.6	< MDA	323.0	3.83	0.34	3.67	0.34	2.44	0.13	1.22	0.16	< MDA	2.42	1.06	0.17	0.29	0.17	0.32	0.15
I-9	2.54	0.18	1.78	0.22	2.02	0.16	< MDA	203.0	< MDA	55.32	< MDA	153.6	3.77	0.25	2.89	0.22	2.36	0.21	1.54	0.84	< MDA	1.04	0.84	0.23	0.44	0.15	0.50	0.17
I-11	< MDA	0.2	0.43	0.22	< MDA	0.30	< MDA	149.6	< MDA	141.1	< MDA	133.3	0.36	0.29	0.9	0.3	< MDA	0.32	1.18	0.72	< MDA	0.78	< MDA	0.11	0.62	0.15	0.47	0.15
I-62	0.4	0.31	< MDA	0.44	< MDA	0.34	< MDA	42.70	< MDA	57.19	< MDA	133.8	0.39	0.27	0.71	0.33	0.38	0.28	1.16	0.55	1.43	0.62	1.63	0.33	0.67	0.22	0.43	0.11
I-65	0.31	0.30	0.34	0.15	0.36	0.03	< MDA	130.9	< MDA	88.22	< MDA	150.9	0.34	0.25	0.58	0.19	0.46	0.04	1.89	0.62	0.61	0.31	< MDA	0.20	0.59	0.14	0.67	0.11
I-66	1.22	0.16	1.18	0.26	0.89	0.02	< MDA	145.8	< MDA	145.5	< MDA	163.2	0.91	0.18	1.23	0.23	1.10	0.04	< MDA	2.54	< MDA	2.62	0.97	0.62	0.66	0.15	1.09	0.35
I-66 DUP (F)	-	-	-	-	3.09	0.17	-	-	-	-	< MDA	137.6	-	-	-	-	14.0	0.2	-	-	-	-	< MDA	0.23	0.56	0.12	-	-
I-67	0.17	0.11	0.46	0.18	0.35	0.03	< MDA	228.2	< MDA	145.4	< MDA	166.2	0.54	0.15	0.34	0.22	0.52	0.05	3.58	0.97	< MDA	2.19	0.61	0.29	0.52	0.13	0.55	0.10
I-68	0.84	0.17	1.48	0.12	1.06	0.13	< MDA	107.9	< MDA	143.6	101	98	1.60	0.18	1.24	0.19	1.47	0.18	< MDA	0.70	< MDA	1.04	0.53	0.15	0.46	0.14	0.21	0.15
I-68 DUP (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.46	0.10
Deep Depth Wells																												
D-3	2.50	0.15	1.40	0.16	0.75	0.09	< MDA	65.68	< MDA	282.4	< MDA	130.8	3.39	0.19	2.47	0.18	1.04	0.09	< MDA	0.58	0.96	0.83	0.36	0.12	0.64	0.26	0.41	0.13
D-3 DUP (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.37	0.10
D-6	0.54	0.35	0.73	0.17	0.36	0.19	< MDA	140.7	< MDA	149.0	< MDA	122.3	1.69	0.34	1.61	0.26	0.68	0.25	0.61	0.47	0.99	0.44	0.71	0.15	0.20	0.16	0.54	0.11
D-12	0.81	0.21	< MDA	0.24	< MDA	0.117	< MDA	83.22	< MDA	82.01	114	92	1.4	0.26	0.43	0.32	0.24	0.17	< MDA	4.66	< MDA	0.77	0.51	0.23	5.08	0.56	0.50	0.12
D-13	< MDA	1.3	< MDA	0.19	< MDA	0.169	< MDA	99.67	< MDA	126.5	< MDA	141.5	2.95	1.26	0.57	0.22	0.44	0.25	4.25	3.26	< MDA	2.15	0.64	0.05	0.29	0.12	0.27	0.10
D-14	3.71	0.26	3.33	0.13	0.52	0.09	< MDA	143.2	< MDA	139.1	< MDA	208.8	4.16	0.29	3.11	0.2	0.57	0.07	0.93	0.55	< MDA	2.23	1.14	0.17	0.24	0.22	-	-
D-83	0.73	0.38	0.33	0.24	< MDA	0.21	< MDA	204.6	< MDA	53.81	< MDA	116.1	0.71	0.44	0.48	0.32	< MDA	0.20	1.24	0.49	0.95	0.48	0.83	0.14	0.40	0.19	< MDA	0.04
D-85	0.21	0.21	< MDA	0.24	0.32	0.30	< MDA	143.8	< MDA	144.7	< MDA	357.7	0.76	0.25	< MDA	0.30	0.58	0.31	1.00	0.59	4.66	3.96	0.92	0.15	0.65	0.20	0.70	0.19
D-85 DUP (F)	-	-	-	-	-	-	< MDA	122.1	< MDA	81.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D-93	< MDA	0.35	0.15	0.12	< MDA	0.18	< MDA	77.99	< MDA	148.1	< MDA	198.1	< MDA	0.47	0.22	0.21	0.42	0.22	0.64	0.36	0.67	0.41	0.53	0.23	0.25	0.10	0.47	0.16
D-93 DUP (F)	-	-	-	-	< MDA	0.13	-	-	-	-	< MDA	324.8	-	-	-	-	0.22	0.17	-	-	-	-	0.78	0.57	0.94	0.18	-	-

-- = Not reported
 xx = No tracer counts. Therefore, results could not be generated.
 DUP (F) = Field Duplicate
 MDA = Minimum Detectable Activity
 PZ-114-AS = Piezometer-114-Alluvial Shallow
 Bolded numbers indicate results above the Minimum Detectable Activity